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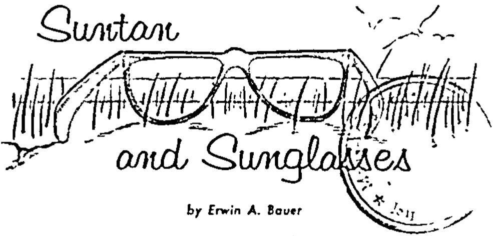
Suntan and Sunglasses



by Erwin A. Bauer

Condensed from The Fisherman

It seems strange, perhaps but year after year many vacations and fishing trips are hampered, even ruined, by the sun It s true, even though the sun is a necessary ingredient to good weather and successful vacations Yet that same sunshine that makes days bright and warm can also make a person sick and uncomfortable enough to switch to a hammock in the shade. Sunburn is no pleasant matter

Sunlight is composed of several kinds of bright rays that have various effects on the earth, on its vegetation, and on its inhabitants The ultraviolet rays, probably, have the greatest effect on humans, both beneficial or harmful Short exposures are beneficial. Prolonged exposure to ultraviolet rays produces exactly the same burn on skin as fire. It's painful, and it can be dangerous.

The Fisherman (June '55), 11 W. 42nd St., New York 36, N. Y. Copyright 1955 by Fisherman Press

Your skin is a multiple layer of cells that keep developing all the time from underneath. The outer layer, called epidermis, is tough and quite thick in places where there is much contact, as in the palms of your hands and the soles of your feet. It's a protective layer, too. It contains pigment, or coloring, that helps to filter out ultraviolet light.

Blondes have less pigment and burn more readily than brunettes, Caucasians burn more quickly than Negroes. Brief or frequent exposure to the sun will develop additional pigment — tanning — and provide more filtering. This is your body's way of adapting to a new condition But when exposure becomes greater than your pigment-filtering plant can handle, you've developed a sunburn.

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The first symptoms of sunb[illegible] a redness, irritation, and occasion[illegible] a "tightening" of the skin. Of

because of cool prevailing winds, all of these symptoms go unnoticed until the sunburn has advanced a little farther—to blistering or even to actual destruction of the skin It's really a painful proposition then.

Burning develops most rapidly where the sun's rays are shortest and most direct. They're shortest the nearer you approach the Equator and the middle of the day. That means sunburn is less likely to develop in temperate zones than in the tropics, because the rays are slanting and filter through more air, dust, and water vapor.

Burning also occurs more readily at high altitudes—mountain climbers and alpinists are always faced with the problem—since the ultraviolet rays come direct and unfiltered by the haze and heavy atmosphere that hovers over lowlands. Mountain climbers also must contend with light reflected from snow and shiny rock surfaces Sunlight need not be direct to produce sunburn. Some of the worst cases develop suddenly from light reflected by water.

But there's really no reason for a person to suffer sunburn in even a mild form, as simple precautions will prevent such an occurrence. First, exposure should be slow and gradual. Start with 15-minute periods and then extend them each day. It may seem he-mannish to strip off a shirt and bake in the sun all day, but the consequences aren't worth it. Be certain that exposed skin is liberally their advertising claims are subject to government regulation.

A good suntan lotion is actually a filter. A chemical that filters ultraviolet light is mixed or dissolved in a creme, alcohol, or oil base to permit easy and even applications. Frequent applications will prevent burn in most cases. But this is important grease or oil applications alone will not do the job. Don't expect them to. Some lotions do contain lanolin but this is more for "feel" and to replace skin oils than it is to prevent sunburn.

If you have a case of sunburn, here's how to handle it: Obtain an ointment that contains a skin anesthetic (such as nupercaine) and apply it evenly. If the burn is in the blistering stage or worse, see a doctor immediately. Do not use tannic acid or any of the old wives' remedies that have been tried through the years. At best, they are not helpful. And often, it's the first step to an infection that can spread.

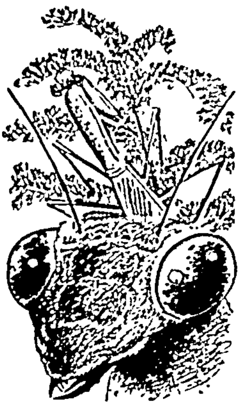
But protecting your skin is only half the battle when you spend long hours under a boiling sun. Your eyes can suffer, too.

Nowadays there are almost as many kinds of sunglasses on the market as there are places selling them. The best that can be said for most of them is that they are unsatisfactory. Beware, generally, of the cheap glasses—the bargains that come in a grand variety of bizarre frames and colors. Price, however, is not always an indication of quality. Some very poor glasses are expensive, and some good ones are relatively cheap.

AMAZING EYES of INSECTS

by Lorus J. and Margery J. Milne

Condensed from Frontiers



EYES are such prized possessions that everyone is interested in how they operate. Our own eyes, built somewhat like a camera, are complex organs in which a lens focuses a little picture on a light-sensitive layer, the retina. According to that little picture, we interpret the world around us.

Many animals' eyes are built on entirely different plans, and we cannot assume they see what we see. Of all the animals without backbones, the largest group with eyes are the insects.

Most insects have at least a pair of eyes. Many adult insects bear on their heads five separate eyes—three in the middle of the forehead and a larger one on each side.

The three forehead eyes, called simple eyes or ocelli, each have a single lens that concentrates light on sensitive cells below it. These lenses are not far enough from the light-sensitive cells for focus and a sharp image to be achieved. As a result, the ocelli are useful chiefly in determining if there is a source of light ahead.

The larger eyes on the sides of the head are more complicated. Each consists of from a dozen to several hundred eye units called ommatidia. An ommatidium is long and tapering, with a lens at its larger outer end and light-sensitive cells deeper. Ordinarily it is shielded from its neighbors by special cells filled with dense black pigment.

Each ommatidium stares unwinkingly at a small part of the sc

Frontiers, the magazine of the Academy of Natural Sciences, 19th and the Parkway, Philadelphia 3, Pa. (Apr '55).

around the insect, and tells the insect the average brightness of the particular part it watches. Different ommatidia record happenings in different directions. Ommatidia do not see fine details as our eyes do.

The whole compound eye, with its many ommatidia, may keep the animal informed of what occurs ahead, above, below, at both sides, and even behind it, all at the same time. A dragonfly, for example, sees in all directions except the rear where the body itself blocks the view. As a result, if one wishes to catch a drag-

Insects differ widely in the number of ommatidia in their compound eyes. Where the number is large, each is responsible for a smaller part of the surrounding scene More accurately, the angle of view is large where the number of ommatidia is small, and small where the number of ommatidia is large. But since each ommatidium tells the insect merely the average brightness over the angle of its view, the detail recognizable in a scene depends on how small that angle of view actually is.

A bee or a dragonfly, with hundreds of ommatidia, sees any object near it as a large number of white, gray and black spots, in a pattern. A silverfish or a caterpillar, with fewer ommatidia, may find no recognizable detail because each eye unit covers too much territory.

This difference is described as the "resolving power" of the eye — its ability to distinguish detail. Our own resolving power is usually measured by the smallness of letters we can read on a chart, and if normal may be described as "20/20 vision." This simply means that a person can read certain standard letters $\frac{3}{8}$ths of an inch high at 20 feet. No insect can see this much detail. But on the other hand, no human eye can watch at a single moment so much of the surrounding scene as can a dragonfly.

Everyone knows how much easier it is to see a rabbit when it runs than when it crouches among leaves. Insects, too, see an object better when that object moves.

A fly may not distinguish a hand or fly-swatter that stays still or moves slowly, but let these objects move rapidly and the fly takes to its wings.

The pattern of light and dark made by the hand in the compound eye of the fly means little if the hand does not move. Once in motion, however, it disappears from the field of view of many ommatidia that had been seeing it. Other ommatidia now record the unfamiliar object. The larger the number of ommatidia which lose or gain sight of the hand in a fraction of a second, the larger the hand must be, or the nearer. The more ommatidia stimulated, the more the fly hurries in escaping.

From the standpoint of the ommatidia, it makes no difference

whether the scenery moves past the insect or the insect past the scenery. The pattern of light and dark shifts from one set of eye units to another, and stimulates the insect. Thus, a honeybee flying over an apple tree in flower sees a large patch of white contrasting with the grass. This patch moves across the bee's field of view, affecting different ommatidia as the bee flies. The bee is likely to react, hurrying toward the flowering tree.

At close range, however, the flowers are seen in contrast with the tree's leaves, and individual blossoms form an attraction. Still closer, of course, the fragrance and nectar add to the features that attract the bee. They provide the reward that trains the bee to pay attention to flowering apple trees.

But the stimulation of a flowering tree for bees is greater when both leaves and flowers are present than with flowers alone, and is even greater if wind blows the branches so that the pattern of light and dark shifts back and forth across the insect's view. Each movement of the pattern draws the insect's attention more powerfully.

In trying to understand an insect's vision, we are likely to assume that objects we see as white, yellow or red are white, yellow or red to the insect. This is not so. In fact, for many insects, like the honeybee or the fruitfly, the brightest part of the spectrum is one to which we are entirely blind—the ultraviolet.

Red light is seen by relatively few insects. To them a red flower may appear either bright or black, depending on whether or not the petals reflect ultraviolet. And of two flowers white to us, one may appear brighter to the insect because of high reflection of ultraviolet.

The honeybee seems to excel other insects in ability to recognize color and to fly from one flower to another of the same kind through this color sense. Yet a honeybee can recognize only four distinct colors — orange-yellow, green, blue-violet and ultraviolet. These it can distinguish from any shade of gray—the only true test for color vision.

Often the colors of light that are visible to an insect can be guessed by examining its own body. Broad patches of bright color are likely to be recognition marks by which one individual recognizes another of its own kind.

A good experiment is to coat an insect's compound eyes with a transparent lacquer containing a dye. If a butterfly such as a red admiral, which has conspicuous red markings on its wings, is fitted in this way with red goggles, only red light reaches the insect's ommatidia. Can the butterfly see its way around in red light? The answer is yes, which means that the insect can use this part of the spectrum in finding a mate.

A cabbage butterfly, on the other hand, has no red on its wings. If equipped with red goggles, it is as blind as though the eyes were covered with black paint. Red does not help it see. Some color-blind humans are almost as helpless if fitted with red glasses.

Actually, the vision of a cabbage butterfly is remarkably poor. In flying over a field of white daisies the white butterfly approaches each blossom as if it were another butterfly, not distinguishing between the two until only a few inches away, or until a real butterfly moves.

Experiments have shown that some fireflies also see red light. The male winks his greenish yellow light while flying over marshy grasslands in the early part of the night. Female fireflies are perched on the grass, with their own lights ready. When a female sees the flash of a male overhead, she signals with her light. If the delay between the male's flash and her reply is the correct fraction of a second, and if the male sees it, he turns and approaches the female. A few exchanges of flashes—she responding to him each time—brings him in to land beside her.

It is possible to hold a captured male firefly in one's fingers and stimulate it to flash by a slight squeeze. If this artificial flash is timed correctly as a free-flying male passes by, he will turn and alight on the fingers. Thus it is not the light of a female, but any firefly light at the correct time, which provides the cue. And a flashlight of small size may be substituted for a firefly.

By using flashlights covered with cellophane of various colors, it has been possible to show that the firefly sees and will approach a light of any color visible to the human eye, even including red.

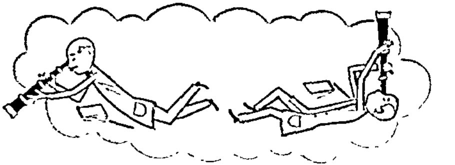
Where an insect eye is large, as in dragonfly and mantis, we can see a tiny black spot on the eye. This spot shifts from place to place as we move around the live insect's head, and is called the "false pupil." Actually it is the ommatidium (or cluster of ommatidia) that is looking directly at our own eye. As we move around the head, we come into the field of different ommatidia, and see toward the dark inner depths of these other eye units as the false pupils. In many positions, we can see a false pupil in each of the two compound eyes.

Missile That Hates H-Bombs

A guided missile which has the specific purpose of destroying enemy bombers carrying hydrogen bombs *before they reach their targets* was recently unveiled by the Air Force The missile, named the Falcon, soon will be carried by all-weather interceptor planes, and will be able to knock down invaders at vast distances from American targets.

The Air Force described the Falcon, a blunt-nosed 6-foot weapon, as the smallest guided missile in production. It weighs 100 pounds, and has an electronic brain preventing it from "making any of the mistakes humans might make," according to Trevor Gardner, assistant air secretary.

Gardner said the Falcon has been "*conclusively* proven," and has an explosive warhead that makes "virtually every hit a sure kill."



Observatories in the Sky

by Lyman Spitzer, Jr.

Condensed from The American Scientist

What is the basic problem of the astronomer? He is trying to analyze what goes on outside the earth. The only way this can be done is by measuring the light reaching us from the heavenly bodies in space. So the astronomer's technique consists in catching the electromagnetic radiation coming from the stars, the galaxies, the nebulae, the planets, the sun, bringing this light to a focus in some way, and measuring its properties.

What are the physical limitations on the accurate measurement of light? The bigger the telescope one can make, the more light can be intercepted. But if the light is to be detected at all, it must first penetrate the earth's atmosphere.

The astronomer is interested not only in visible light, but in the whole electromagnetic spectrum, and from this standpoint scarcely any light reaches the earth at all, since most of it gets absorbed in the earth's atmosphere.

Air transmits visible light; it also transmits a few radio waves. But that is about all that gets through. X rays, most ultraviolet and infrared light, most radio waves, including the normal broadcast bands — none of these gets through.

Moreover, what light does get through becomes distorted by the atmosphere. If one tries to photograph an object such as the surface of the planet Mars, the entire photograph becomes obscured by the air motions which bend the light back and forth.

If the bottom of a tank of wavy water is viewed from above - tom seems to shimmer, way, if one is at the

The American Scientist (Apr '55); published by the Society of the Sigma Xi, at the Mack Printing Co., 20th and Northampton Sts., Easton, Pa.

tank, looking up, objects above the water cannot be seen clearly if there are waves at the surface. Exactly the same thing happens at the base of our atmosphere. These limitations are extremely serious; the 200-inch telescope at Mt. Palomar, for example, practically never has the full effective viewing power which it would have in a vacuum.

We see that the air provides two basic limitations for the astronomer. First, most of the electromagnetic radiation does not get through the air; secondly, what does get through is distorted. To get around these two limitations, there is one simple solution, which is to put an observatory above the atmosphere.

This may seem rather visionary, but I am convinced that this is the next important instrumental step in astronomy. There have been several attempts in this direction already. Big rockets have risen some 50 to 100 miles above the earth's surface, carrying small telescopes to photograph the ultraviolet light which does not penetrate the atmosphere. Measures of the solar spectrum in ultraviolet light have yielded very interesting results.

The program has been somewhat

Professor Lyman Spitzer, Jr., is chairman of the astronomy department and director of the observatory at Princeton University. He is an expert on theories of the universe, interstellar matter, the atmospheres of stars and problems of the earth's own upper atmosphere.

limited, since rockets are above the atmosphere for only a few minutes, and they do not carry much instrumental equipment. Besides, all the equipment gets smashed when the rocket falls down to earth again. (Only the records are preserved.)

High-altitude research with great rockets was at first a rather discouraging program. When the rockets were in the experimental stage, quite a few of them blew up before they got very high. Now the use of rockets is becoming a standard technique for making observations from great heights.

There have also been some plans made for taking photographs from high enough up so that the atmosphere does not distort the image on a photographic plate. A colleague of mine, interested in the pattern of the solar surface, scanned the photographs of the sun that had been obtained by the big solar telescopes,

a 4-inch telescope.

In principle, bigger telescopes yield sharper images; but actually, because of the shimmering atmosphere, the photographs obtained with larger instruments were no sharper than those obtained with a little 4-inch telescope.

So it is difficult to say very much about the detailed structure of the sun's surface. One could do very much better by sending a 12-inch telescope up in a balloon, and using modern guiding equipment to keep

the telescope pointed very accurately at the sun, taking very short exposures. A group at Cambridge, England, is reported to be building a telescope of this sort, designed to be carried up with a balloon 10 or 20 miles above the earth's surface to take photographs of the sun.

We have done a little computation to show whether this might be used for Mars, in an attempt to photograph the famous but controversial canals. It has even been suggested that the best possible use we could make of our 23-inch telescope at Princeton would be to send it 20 miles up!

While such a suggestion is somewhat controversial, there is no question that a 23-inch telescope high above the earth's surface could, in principle, do better than the 200-inch telescope on the earth's surface in photographing small detail on the surface of any of the planets.

ROCKETS and balloons are both simply preliminary steps. The logical solution to the astronomer's problem is to send an observatory up 500 miles, going around the earth every hour and a half in a permanent orbit to form an artificial satellite of the earth. There have been several studies of how one might launch a satellite observatory. While there are many difficulties and many complications, such an observatory seems definitely possible. If the military keep sending up bigger and bigger rockets, it is only a question of a few decades before the astronomers can go along for the ride, and observe the stars from an altitude of 500 miles.

What would the performance be of such a satellite observatory? Let us suppose that we can send up a 40-inch telescope, which would measure the light by the ultra-sensitive photoelectric cell. Such a telescope could "see" objects that are only ⅟₁₀₀th as big as the smallest object which the 200-inch telescope can now record on a photograph.

It could detect galaxies perhaps as much as five times further away than the most distant object seen with the 200-inch telescope. The entire electromagnetic spectrum could be observed.

There would be many difficulties in getting up to such an observatory and down again The simplest solution might be to have the satellite entirely unmanned, transmitting its information down by short-wave radio. A very serious problem with such an observatory would be to keep it operating if no one were there to maintain it. Probably, one would need a little installation that would change tubes if they went bad

The power required for operation could easily be obtained from the sun. The Bell Laboratories have recently devised a solar battery which can give about 50 watts per square yard of surface. With a few square yards one can easily get the low power that would be needed to operate a radio set and a few small motors.

ONE of the advantages of goi out into space for a big

servatory is that one does not have to worry about the force of gravity. A big telescope on earth tends to bend when it is turned in different directions. To counteract this tendency, a big telescope must be made rigid. The rigidity needed becomes more and more difficult to obtain with increasing telescope size, and limits the telescope diameter to a few hundred inches.

When we get out into space, there is no such limitation on the size of the telescope. Perhaps a few centuries from now we will build a 1,000-inch satellite telescope. Such a gigantic instrument would probably have to be put together out in space.

I am convinced that once astronomers get out into space, the whole subject of astronomy will be revolutionized. The accuracy, precision, depth, range and scope of astronomical observations will all be enormously enhanced by a satellite observatory.

Evidently, there is much astronomy just over the horizon.

Martian Volcanoes as Active as Earth's

Volcanoes on Mars apparently erupt about as frequently as those on earth, Dr Dean B. McLaughlin of the University of Michigan told the American Astronomical Society

Dark areas on the Martian surface, he believes result from deposits of drifting volcanic ash falling out in the pattern of prevailing winds.

These winds, Dr. McLaughlin said, "behave precisely like the well-known monsoons of India."

Several prominent changes have occurred on the Martian surface over the last 150 years, Dr. McLaughlin found from a study of observations made of the planet by other astronomers prior to 1930. Four of these could be explained only by volcanic action at a definite location. In three of them, a large dark spot is now visible at this place.

From all four volcanoes, Dr. McLaughlin's historical research showed, dark markings had fanned out in the direction to be expected from monsoon-like winds. These markings were horn-shaped, curving as expected from the planet's rotation, to the right in the Northern Hemisphere, to the left in the Southern Hemisphere.

A few cubic kilometers of ash would be enough to account for these markings, Dr. McLaughlin said. Such ash deposits on Mars are "not any greater than those of large terrestrial eruptions," but rainstorms, streams and rivers, and plants that hide or erase ash here are non-existent there. Thus only the winds drift volcanic ash about, later concealing it with desert dust or a new ash layer.

[illegible]

that on the earth."

—*Ann Ewing for Science Service*

Getting Rid of "Trash" Fish

by Hart Stilwell

Reprinted from Sports Illustrated

A LAKE overrun with "trash" fish (carp, shad and others) offers poor sport because there is too much easy feed for game fish Now many such lakes are being poisoned and, when the water becomes pure again, restocked with game fish. The method is costly and time-consuming but it works. Recently a new poison technique has appeared with such startling promise that the whole future of lake fishing may be in for a tremendous uplift.

Briefly, a way has been found to poison out shad, various species of which glut lakes all over the country, without harming the game fish Intensive research is going on to apply this selective killing to other trash fish. Imagine a lake suddenly cleared of the young fish that game fish have been living off all their lives!

The discovery was made in Texas when a routine poisoning got out of hand. Leo D. Lewis, an aquatic biologist with the Game and Fish Commission, netted off an arm of privately-owned Lamar Fain Lake near Wichita Falls, intending to poison this small area first and take a sampling of its fish population. But after Lewis had put in his rotenone a storm came up and mixed the poison throughout the lake so that the concentration was a tenth the usual killing dose

Shad started flinging themselves about in a dance of death By the next day the lake was littered with windrows of dead fish — all shad With growing excitement Lewis persuaded the owner of the lake to drain it. They found the astonished game fish (black bass, crappies, perch and catfish) vigorous and apparently unaffected. Some trash species had also survived. But not a single shad.

At a smaller fish-club lake near Woodvale a check revealed that 51.7 percent of the fish were shad. The new technique was applied, and

Sports Illustrated (Apr 18 '55), published by Time, Inc, 9 Rockefeller Plaza, New York, N Y

the first day's fishing three weeks after the treatment, more fish were caught than in the previous year.

At Camp Creek, where the shad kill was not complete because brush and weeds prevented a thorough intermingling of the poison, bass fishing improved by almost 1,000 percent and the crappie take by 500 percent.

The only fairly large body of water in Texas so far treated is Lake Wichita near Lewis' home base. Immediate results were the death of 36½ tons of trash fish, mostly shad. The muddy lake also was cleaned magically until it was sparkling and clear. Fishing has improved remarkably but there hasn't been time for a long-range check.

I recently witnessed the application of a new concentration of the poison, .5 of a pound of rotenone per acre foot instead of the bare minimum of .3 of a pound needed to kill shad, which was discovered by Leo Lewis nearly two years ago. Lewis and his assistant, Dr. Walter Dalquest, had dosed a small lake the day before. When I arrived the shad were dead and carp and buffalofish and carpsuckers were drifting to shore by the hundreds.

This and other experiments have shown that .5 of a pound is just about the breaking point—it will kill most of the trash fish, excepting gars and few game fish. That day I saw only a few small crappies and an occasional young bass or perch.

The odd thing about shad hordes throughout the country is that the average fisherman doesn't even know they exist, much less that they ruin his sport Most species are shy fish that are rarely caught. Yet they exist in uncounted millions. The gizzard shad alone is increasing its range and numbers to an extent that it is almost a national problem, according to Richard H. Stroud of the Sports Fishing Institute. This fish ranges throughout the Mississippi watershed, as far north as Ohio and Iowa, and eastward as far as New York, thence south through the TVA system of rivers and lakes, and beyond throughout Texas and Oklahoma and most of the Southwest.

Walleyed pike were introduced into TVA lakes years ago and have caught on to an unusual degree. Netting crews say that 10- and 15-pounders are commonplace, yet almost no one catches walleyes in the TVA. The harvest is only a very small percentage of those available. Biologists believe the cause is an overabundance of shad.

Fortunately, thanks to that sudden storm in Texas and an alert biologist, shad and others will soon be controlled with a fine hand and U.S anglers may discover that the lake just outside town hasn't been "fished out" after all.

More than 300 pounds of steel per day, on the average, is made into fish hooks. About 3,000 of the popular size No. 6 trout hooks can be made from a pound of wire.

SCIENCE FRAUDS AND FAILURES

by Georg Mann

BACK IN 1938 a monument was erected to honor Charles Dawson, a "scientific pioneer" who—as was thought then—had made a major contribution to man's understanding of his own past through the discovery of the half-million-year-old remains of Piltdown Man in 1911.

Two years ago—you probably remember the headlines—the roof began to fall in on Dawson's memory; he himself had gone peaceably to his fathers in 1916. The skull fragments of man's remote ancestor were shown to be a mish-mash of human and orangutan remains — the latter, modern. The human bones were 50,000 years old, a dime a dozen among antiquaries in Europe. The ape's jawbone had been stained with potassium bichromate and iron salt to make it look old; the teeth had been prosaically ground down.

The experts figured Dawson as the victim of a hoax, until they looked further. The original dig in Piltdown, 40 miles south of London, was found to contain a flint tool, artificially colored to simulate age. A tool made from the thighbone of an extinct elephant was also discovered not to be as claimed.

Last December, it become apparent that if anybody had "salted" the original discovery, it must have been

Dawson himself. His collection of "antiques" had been sold to museums. Many of them, bronze axes, flint spears, and implements, were found to be false. Some of the flint instruments, according to J. Manwaring Baines, curator of the Hastings Museum, which acquired much of Dawson's collection, were the work of a noted faker named Flint Jack.

A statuette said to be the first example of cast iron in Europe, and a medieval horseshoe are equally suspect. And finally, *A History of Hastings Castle,* ostensibly written by Dawson, turned out to be largely cribbed from a book written by a William Herbert a century earlier.

Why did Dawson do it? At this distance, nobody can tell. Yet, that frauds exist in science is undeniable. Sometimes they arise from greed, sometimes from the serious conviction of a scientist that this is the way things ought to be—even if the evidence has to be joggled a trifle. (Wise scientists keep a close check on junior assistants, who have been known to alter evidence in favor of what they think their seniors really want to prove.)

Fortunately, the progress of science has limited the activities of the fakers. Now, results by one scientist must be verified by other scientists repeating experiments on the basis of complete information given by the original discoverer. Where such information is not given, suspicion is obligatory. Hence "secret" drugs for treating disease are ignored by the medical profession.

The present-day disputed areas of science involve certain fields of biology, where observation, rather than controlled experiments, provide the evidence. They are found in cosmic thinking about the universe, where the existing thinking is very complex. And, as Dawson found out, they concern areas of man's past.

In physics, an entire volume could be written about announcements of mysterious radiations. More than a century ago, Baron Karl von Reichenbach, a respected chemist, member of the Prussian Academy of Sciences, announced the discovery of a mysterious force, appropriately named "od," in the respectable *Annalen der Chemie und Physick.*

Od could be detected only by people who were especially sensitive to it, and could be detected as either "positive" or "negative." A whole "psychic chemistry" developed which led to a table of odically positive, odically negative, and odically neutral chemical elements.

In Reichenbach's hands, od explained practically everything — Mesmer's animal magnetism (hypnotism), the divining rod (the latter is scarcely a *scientific* fraud), and even ghosts.

Unfortunately, the mysterious force could be neither developed nor detected in other laboratories, and the whole idea collapsed.

With Roentgen's discovery of X rays in the 1890's, everybody wanted to get into the radiation act, and in retrospect, it seems as if everybody did.

Blondlot's "N-rays" were an ar-

rival of the early 1900's. Blondlot, a distinguished French physicist, reported slight increases in the brightness of certain phosphorescent surfaces under special circumstances in a dark room. These images developed slowly, faded away, and could not be seen by all observers.

Blondlot tested the rays under a variety of laboratory conditions. He reported that using gold heightened the glow, that neither aluminum nor paraffin had the apparent ability to store X-rays. Yet some archeological objects gave off this radiation, showing that under the proper circumstances it could be stored for centuries.

Blondlot received some support among his colleagues; others, attempting to duplicate his experiments failed completely. Finally, an American observer named Wood brought the entire concept crashing down. In the midst of certain laboratory experiments, Wood surreptitiously removed an essential prism from the apparatus, while Blondlot's assistant continued to brightly describe the phenomena they were expected to see.

"Mitogenic rays" enjoyed a brief vogue a generation ago. These were invisible radiations given off by the dividing cells of plants, and were

existence could be demonstrated by their ability to cause other nearby plants to sprout. This time, botanists checked on the influences that could cause a plant to sprout without the aid of mitogenic rays, which disposed of them.

• We of the mid-twentieth century have been moving forward to a considerable degree because of the momentum accumulated in the days of the amateur and the lone inventor. . . . Whether there will continue to be a favorable cultural atmosphere for the exceptional man with really new ideas in science I have some doubt —Dr. James B. Conant

During World War I, American radiology journals heralded the discovery of colored X rays, and this at a time when color photography itself had not emerged. The journals described nerves, muscles, and other soft tissues clearly outlined in color on X-ray plates. The reports seemed almost too good to be true.

They were. The colored X rays, investigation showed, had been turned out by a bored British army hospital technician who colored a few negatives with dyes and a camel's hair brush for his own amusement. The plates fell into the hands of the top brass in the hospital, were proudly shown about, and the technician went along with the gag. When closer examination showed the fake, some highly rated scientific journals had to eat their own words.

It was the same technician, apparently inspired by his transitory success, who then proceeded to a more spectacular fraud. He developed a "death ray," which was promising enough to be demonstrated before experts. The magic, death-dealing box was brought to a field, and number of experimental ani were released one at a time. The

was focused, the ray turned on, and one by one, the animals leaped up in a death agony.

To make sure, the experts autopsied the animals. Then they discovered that strychnine had been injected into them before hand. On the caged animals the drug's effects were slow. But once the animals were freed and sprang into action, the drug worked swiftly. Each animal ran a few yards and dropped dead. The technician was clever enough to vary the doses for the size of the animal so each dropped dead at approximately the same distance.

In the 1920's, a scientist at the Pasteur Institute caused a sensation by announcing a "radium serum." This could be injected into cancer victims and would give off radiations to show where the growths had spread. Injected in pregnant animals, it clearly outlined the fetuses, by what we know today as radioautographs.

Today, with the use of radioisotopes such results are routine. Then, they weren't even possible. The Russian-born scientist's enthusiasm had completely outrun his facts.

One of the latest mysterious radiations was "sunrise" radiation, with its "cosmoterrestrial" effect. In 1941, two Japanese biochemists, M. Takata and T. Murasugi, reported dramatic changes in human blood, depending on whether it was sampled before or after sunrise. The subject had to be electrically insulated from the ground, but the changes took place even if the subject were hidden in a cellar protected by thick layers of earth or of heavy concrete.

Since then, Hans Bomke of the Evans Signal Laboratory spent three years trying to duplicate the changes reported by the Japanese, in more than 100 experiments exposing persons to the supposed sunrise radiations. Using far more sensitive measuring techniques than were available to the Japanese at the time, he came to but one conclusion. No such effect.

History is also full of reports of strange animals—even strange "creatures"—that lurk in wait at the borderlines of the still not so thoroughly explored world. In recent years we have had the "Abominable Snowman" of the Himalayas, that left inexplicable tracks in its journeys across the snowy mountain wastes.

A Tibetan lama reported that some such eight-foot tall creature had joined a colleague of his in meditation atop a mountain peak. The reports were so convincing that a British expedition, complete with zoologists, alpinists, and photographers was sent on the trail of the mystery. Whether the reports referred to apes, men, or bears—and all were suggested—the verdict is not yet in. We do have photographs of the tracks, apparently.

Equally, if not more baffling, were last year's "Ape Men of Malaya." These hairy, fanged, tapioca-eating creatures came out of the jungles, frightening plantation laborers half to death. Popularly, they were considered crosses between apes and men, while an anthropologist suggested they might be white men who had gone native. The observers only

agree they had a language of grunts and whistles, and were familiar enough with rifles to head for the rivers or hills at the sight of one.

So far, there have been no further reports of these Ape Men.

Most perennial of the biological wonders is the Wolf Boy, a human being raised by wild animals. Perhaps the latest of this tribe is a nine-year old Hindu named Ramu, who was found last year in the third-class waiting room of a railroad station in Lucknow, India. Ramu was examined by many experts, some of whom believed he may be the first genuine example of a human raised among animals. Others, more skeptical, were inclined to think of feeblemindedness.

If Ramu does turn out to be genuine, he will be the first wild-animal-reared human whose credentials have been scientifically accepted.

It is in the field of cosmology where the fixed idea can spur ignorance to embroider on what is reliably known. The speculations of Immanuel Velikovsky that roused the scientific community to wrath a few years ago are already being forgotten

And two years ago, a West German patent attorney named Gottfried Bueren was so confident of a new theory of his he offered to bet $6,000 that science would accept it.

Bueren believed that the sun was a hot, hollow sphere, a million miles in diameter. Inside, previously overlooked by astronomers, was a 600,000-mile-thick core that was cooler and lush with vegetation The German Astronomical Society accepted his bet and allowed him to pick his own jury of recognized experts.

When the scientists demolished his ideas, Bueren refused to pay. He was taken to court, and the jury agreed with the astronomers, ordering Bueren to pay the $6,000, plus interest and court costs.

Not so long ago Berliner Valentin Herz announced that the earth revolves in the opposite direction to what you and I have long believed. Argentinian Antonio Duran Novarro at the same time decided that the earth itself is really a hollow ball. People live on the inside, and the sun and the rest of the universe are located somewhere close to the center of the hollow sphere.

In some fields of biology, unfounded speculation is equally rife. It was the Hindu scientist Bose who discussed the biology and psychology of plants in terms of emotions and heart beats, without winning any appreciable world-wide support.

An older example was recently resurrected by Samuel Hopkins Adams, who further debunked the fable of the degeneracy of the Jukes family, long a keystone in the arguments of those who would improve the human breed. Richard Dugdale in 1875 published a study of the blood lines of the Jukes family (fictitious name), pointing to the "hereditary" degeneracy of the strain. Adams showed that Dugdale was guilty of irresponsibly collecting unproved gossip and rumors, of g[illegible] izations based upon the [illegible] sible genetics.

Here was a case in which a supposed scientist (Dugdale was a social investigator) tailored his data almost entirely to fit his cloth, accepting whatever was bad about the Jukes, fearlessly using the worst possible interpretations, and neglecting whatever failed to suit his main thesis. Reading Adams, the reader tends to become convinced that if anything was wrong with the Jukeses it was environment, not heredity.

On the other side of this issue of heredity versus environment, the biggest fraud in modern science stems from a relatively obscure Viennese scientist named Paul Kammerer. He was essentially a hobbyist who specialized in amphibians In the early 1920's, he wrote a book, at first widely acclaimed, showing that environment, contrary to all accepted scientific belief, could really change heredity.

Kammerer's experiments were based on changing the physical characteristics of the male of the midwife toad, who ordinarily takes upon himself the task of launching his brood upon the world. Shifting the environment caused one group of males to lose interest in rearing their offspring; and more amazingly, another group developed the so-called nuptial pads, characteristic of toads that lived in other environments. These little horny pads appeared on thumbs of the male midwife toads.

When Kammerer described the development of the pads—equivalent to developing a strain of tailless mice after cutting off the tails of several generations—he was hailed as the man who began where Darwin left off. The Russians invited him to come to Moscow; British scientists hailed his discovery.

Then the bubble broke.

An American scientist dissected a specimen, and found that the nuptial pad was really an injection of India ink. Kammerer committed suicide, blaming unnamed other persons for the fraud.

The Russians, however, took up his cause and hailed him as a martyr to science. A movie called *Salamandra* celebrated Kammerer as the victim of a joint plot between priests and capitalists to discredit true science.

A more direct result of Kammerer was the adoption of the "fact" of the inheritance of acquired characteristics as a major touchstone of Russian science. (Standard biology teaches that acquired characteristics cannot be inherited; example, the tailless mice mentioned earlier.) Those who disputed it, like the great geneticist Vavilov, were allowed to die painfully in concentration [illegible]

given major honors, in the hope that a botanical Garden of Eden could be created on the snowy tundra and windswept steppes.

From last reports, this hoax has come home to roost. Lysenko's agricultural experiments with "acquired heredity"—which if successful would have increased food and farm crops—have failed. Russian agriculture is the sore spot in the Soviet economy and Lysenko's star is fading.

SOCIAL CLIMBERS, EASY-GOERS, BOTH TYPES GET ULCERS

Social climbing might be playing an important part in multiplying ulcers This was the charge of a Harvard anthropologist, Dr Benjamin D Paul, made before the National Health Council. Dr. Paul said that social scientists are exploring areas of social strain as possible determining factors in such ailments as ulcers.

Doctor Paul said that social climbing, which he called "social mobility," was one of the "cardinal features" of America's open class system. He said that striving for this mobility generated anxiety, a factor in causing ulcers.

But at the same time another physician disposed of the popular idea that ulcers are solely the lot of tense, hard-driving, excitable persons. According to Dr. Arthur A. Kirchner, vice president of the American College of Gastroenterology, the mild and easy-going person can develop ulcers too.

Ulcers, said Dr. Kirchner, are "brought on by a long period of pent-up feelings and not necessarily by an immediately preceding episode of emotional stress."

And pent-up feelings, he pointed out, are not the exclusive province of the hard-driving person.

RECOMMENDS "OLD-FASHIONED" WAY OF RAISING CHILDREN

A revision in American child-rearing which might produce more neurotics but fewer psychopaths was advocated recently by Dr. Douglas M. Kelly, professor of criminology at the University of California.

The old-fashioned strict type of upbringing, the psychiatrist said, may have inhibited the child and turned out many neurotics, as the Freudians maintain. But, the child-rearing methods of Freud's disciples is a major reason for the rise in delinquency, Dr. Kelley maintained.

He said the Freudians put across the idea that a child should receive a minimum of discipline. The Freudians maintain if you cross the child, his psyche will be warped, and he will be a neurotic.

As a result, immature childhood behavior is more often perpetuated, and in the adult such behavio psychopathic and destructive

Doctor Kelley says it is

to try to find a middle ground between the two schools of child-rearing. He admits that he does not have a compromise formula, but says that when in doubt he favors coming closer to the old-fashioned methods that teach self-control.

This may produce more neurotics, he admits, but it will produce fewer psychopaths and less delinquency.

BOUQUET FOR BACHELOR GIRLS

Girls who stay single, at least for a while, are apt to be better adjusted to life than those who rush into marriage, according to a study made by Floyd M. Martinson of Gustavus

Adolphus College, St. Peter, Minn., [illegible]

[illegible]

personal freedom and fewer withdrawing tendencies." They also had more social aggressiveness and fewer anti-social attitudes.

Marriage counselors often emphasize that marriage is for the emotionally mature, but as Martinson writes, "It may be that it is the immature or not-so-well *adjusted* person for whom marriage *has* its strongest appeal."

This would seem to be borne out in a report made to the National Association of Deans of Women by Hilda Threlkeld, dean of women at the University of Louisville. She remarked that whereas girls used to be expelled from school for marrying, nowadays they feel "hopeless if they haven't a marriage at least in sight by commencement."

HOW GOOD?—DRUGS FOR MENTAL ILLNESS

How good are the new drugs for mental illness being widely tested by psychiatrists?

The experience of Chicago doctors is favorable, reports Arthur J. Snider in the *Chicago Daily News.* However, no one believes the drugs will "empty mental hospitals," as some enthusiasts have prophesied.

On the basis of six-month studies, the drugs, known are chlorpromazine and reserpine, appear capable of:

- Converting quarrelsome, even violent and combative patients into quiet and cooperative ones, thus making them more submissive to treatment.
- Bringing some withdrawn schizophrenics, the most difficult type to treat, out of their shell.
- Reducing the number of electric shock treatments required.
- Possibly enabling some patients, including schizophrenics, doomed to a lifetime in an institution, to return to their homes.

"Tranquilizer is the best description for these drugs," said Dr. Roy Grinker of Michael Reese Hospital's psychiatric institute.

"They are the best pharmacologic agents to come along since the barbiturates," Dr. Grinker said, pointing out that the new drugs soothe without making the person sleepy.

FORMULA FORECASTS WAR

Will Russia go to war?

Statesmen and historians have speculated on the question ever since World War II.

Now, for the first time, a formula has been devised by a group of social psychologists that may throw some scientific light on the possibility, reports Arthur J. Snider in the *Chicago Daily News*.

Applied to Russia, the formula furnishes this ominous answer:

Russia is or will be war-prone in the near future.

The formula reads "Pw equals .60 F-1 plus .19 F-2 minus .06 F-3."

Pw stands for "possibility of war." F-1 represents "cultural pressure"; F-2, "industriousness and capacity to conduct war," and F-3, the "ripeness of culture."

Professor R. B. Cattell, head of the Social Psychology Research unit at the University of Illinois, gives this interpretation:

"Russia is starting relatively late upon its path of industrialization and urbanization.

"We may expect that it will reach a higher level of need for aggression against other countries and a more insistent demand for political expansiveness than characterize most other countries of the world."

More colloquially, he says:

"The plotters in the Kremlin might concern us less if they sat in the saddle of a jaded horse, but the evidence seems to be they ride a steed likely to be "feeling its oats.'"

The formula grew out of a five-year study by the psychologists.

Sixty-nine countries were analyzed over a 100-year period. Eighty behavior indexes of national life were assembled in each.

Among them were literacy, ratio of divorce to marriage, frequency of political assassinations, severity of depressions, frequency of treaties, income, number of telephones.

To the 80 indexes was applied a complex statistical method called

"factor analysis" This is a technique for showing how a complicated mass of measurements relate to each other.

As a possible guide to statesmen interested in predicting action of nations, the formula has drawn the interest of the State Department.

ROADSIDE OBJECTS, BLACKTOP MAY BE TRAFFIC HAZARDS

Do you swerve toward the center of the highway when roadside objects loom up? Do you try to avoid blacktop stretches on a concrete highway?

If you are an average motorist you do, research conducted by Harry Case, Robert E... Slade Hulbert of

California at Los Angeles indicates.

In one highway study a large black panel, whose size could be changed, was set up alongside the road at various distances from the road's edge. Motion pictures of passing motorists' reactions showed that they tended to swerve toward the center of the highway about 110 feet away from the object. The amount

of swerve was directly related to size of the object and its distance from the highway's edge.

In another study motorists' reactions were photographed on a stretch where a three-lane concrete highway was widened by adding a blacktop lane. It was found that the majority of motorists avoided the blacktop lane and some even swerved across the center of the highway upon encountering it.

It was concluded that highway engineers should consider this "barrier effect" in design of approaches to bridge abutments and other roadside structures and in the use of blacktop on concrete highways.

"COCKTAIL FOR LEARNING"

Occupational aptitude tests and electronically measured reactions were laced with whisky in a "cocktail for learning" at the Illinois Institute of Technology, reports Robert S. Kleckner in the *Chicago Sun-Times.*

It was done as a sober project under supervision of psychologist Russell H. Levy.

For years there have been many types of investigations seeking to determine the effects alcohol might have upon the body and mind.

Levy was interested in another aspect. How does alcohol affect learning and retention of what is learned "under the influence?" Does the mind get so befuddled that it cannot remember?

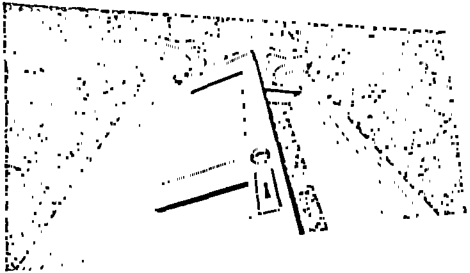
Instead of using natural or artificially induced sleep to lull the minds of his subjects, Levy used whisky. There were 39 subjects. Prior to the tests the subjects fasted 12 hours, then rested an hour.

Levy then gave them three ounces of 100-proof whisky mixed with one-fourth water. They could drink it as slowly as they wished—so long as they downed it within three minutes.

After a short wait, tests began. One consisted of putting square holes over square pegs on what is known as the video-motor board. This is done in various combinations and movements, with an electronic counter and timer giving foolproof scores.

After an extensive series of several tests Levy concluded:

Retention of what is learned with a moderate amount of alcohol in the body apparently is just as high as that of persons who have had none. Also, learning was accomplished at approximately the same rate by individuals given the whisky and those not getting it.



Understanding the Universe

by H. P. Robertson

Condensed from Engineering and Science

THROUGHOUT most of human history the earth was regarded as the center of the universe. A great revolution in astronomical thought, barely 400 years ago, first effectively replaced the earth by the more stable sun as the pivotal point about which all else moved.

But the sun, as well as the earth, was destined to lose its claim to occupying the central position in the universe. Already in the 17th century there were those who envisioned an infinite universe more or less uniformly populated by stars: stars which might even be accompanied by lesser bodies like the earth and the other planets

• • •

But this too-simple picture was, in turn, destined to give way before the advancing front of observation, made possible by the development of the telescope from the puny tubes of Galileo to the mighty reflectors now studded over the face of the earth What these revealed to us was that while the sun was indeed but a member of that system of stars which made up the Milky Way, this system was itself a strictly limited
though one consisting of many
lions of stars, and so vastly ex
that light would take a hu

Engineering and Science (Feb '55), published [illegible]

thousand years to cross from one edge of it to the other.

This mass of stars was found to be arranged like a great lens, with the sun about half-way from the center to one side. From our vantage point on the earth most of the stars seem to be spread out like a great veil wound around the sky. And as we study it, we see in the galaxy a universe of stars rotating slowly about its center, but so vast in extension that the "Cosmic Year" required for one revolution of the system is a hundred million times that year in which the earth revolves about the sun.

Is this, then, the universe? If so, we can place its center at that point, some tens of thousands of light-years from us in the direction of the constellation Sagittarius [illegible]

we are forced to deal, I have used the astronomers' most expressive unit of distance, the *light-year*—that is, the distance light travels in one of our terrestrial years.)

The most striking feature of this galaxy of ours is its myriad of stars, but the telescope reveals that among these stars are other types of objects—compact clusters of stars, bright patches of luminous matter, and dark patches of matter dimming or even obscuring the light from stars beyond.

Among these other objects are little fuzzy blobs of luminous matter called nebulae — or, more precisely, extra-galactic nebulae, for the improvement in our observing instruments and methods within the century has enabled us to identify these tiny dim patches as themselves great collections of stars and other luminous matter, comparable in every way with our own galaxy, but lying far without its borders.

The most conspicuous, and one of the very nearest of these, is the Great Nebula in the constellation Andromeda, which we now place at a distance of well over a million light-years from us. This distance has, within the past two years, been upped from the previously held figure of 700,000 light-years to nearly twice that.

It is estimated from the number of nebulae which show up on plates taken with the great telescopes, that there are, within the range of the 200-inch Mount Palomar reflector, almost a million million nebulae, and that these nebulae are more or less uniformly distributed throughout a sphere whose radius is 2 billion light-years.

The typical nebula of this great collection contains as much luminous matter as ten thousand million of our suns—and could harbor, in addition, as much or more dark matter in the form of gas, dust, or dead stars. The nebulae are often found in groups containing from a few to clusters of hundreds of members, loosely bound

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the [illegible] expanding universe.

IS SPACE CURVED?

We cannot directly visualize the possible curvature of 3-dimensional space, but we can understand it in terms of two dimensions. There are three possibilities:

The universe is flat, and infinite in extent. This is the kind of space visualized by Newton

Space has a positive curvature, and closes in on itself. Such a universe would be finite

Space is saddle-shaped meaning it has a negative curvature, and is infinite

together by their mutual gravitational attraction.

This, then, is the astronomical universe as we now conceive it to be: a grand aggregation of billions of nebulae, separated from each other, on the average, by millions of light-years And since these nebulae are scattered pretty much at random throughout the whole of the visible universe, man's search for a true center has come to naught—every part of this vast domain is much the same as any other.

Perhaps the most striking feature of the extra-galactic nebulae, as we view them from our position within our own galaxy, is that they all (with minor exceptions) appear to be fleeing away from us, and that the farther away they are, the faster they are going

We do know, from the terrestrial experiments, that light from a bright source can be broken up by a spectroscope into wavelets of characteristic wave-lengths When this same source is receding from us these characteristic wave-lengths are increased by a factor which depends sharply on the velocity of the source relative t us—that is, they are shifted to the red end of the spectrum. comparable to the Doppler eff

sound, where the pitch of the whistle on a receding locomotive is lowered by the motion.

When light from a star or a nebula is observed through the spectroscope, bright lines appear which, because of their relative positions and intensities, are identified as characteristic of certain of the chemical elements which can be isolated here on earth, and which are therefore assumed to exist in the heavenly body under examination.

But in the case of the nebular light these bright lines are observed to be shifted toward the red end of the spectrum, and the inference is quite reasonably made that this shift is caused by the motion of the source away from us. This is the basis for the assertion that the nebulae are fleeing our galaxy, and that the further away they are—that is, the dimmer they appear—the greater is their velocity of recession.

Observations with the great reflectors yield Doppler shifts which are interpreted as due to velocities up to almost one-fifth the velocity of light. At the top end of the scale, then, we find objects whose velocities are well over 30,000 miles a second, at distances approaching 700 million light-years!

But nebulae can still be seen when their light is too weak to be spread out effectively into its component wavelets in a spectroscope. Could we measure the Doppler effect in nebulae at the limit of our present capabilities of observation, and if its rate of increase held up at these greater distances, we should expect to find nebulae receding from us at half the velocity of light—more than 90,000 miles a second!

Yet our own galaxy is in no way singled out as a unique center of this expanding "model" of the universe; an observer on any other nebula would find that all the nebulae, including ours, appear to be receding from him in accordance with exactly the same velocity-distance relationship as applies to our own observations.

How will this expanding model behave; what is its future, and what its past? If we ignore for the moment interactions between the nebulae, we would predict that each pair will continue to move apart at the same rate as at present, and that they have been so moving ever since the beginning of time. This would imply that about 3½ billion years ago all of the nebulae must have been bunched together within a quite small region of space, and suggests that they are now flying apart with the velocities acquired in some great primeval explosion.

And here we run into our first hint of possible trouble with the model, for the geologists tell us that the earth itself must be some 3 or 4 billion years old. This near coincidence is by no means fatal to the model, for it may well be that the earth itself is some minor by-product of the initial cataclysm. Nevertheless, the time-scale is uncomfortably short, and alerts us to the danger of winding up with a model universe whose age is less than that of one of its minor inhabitants, the earth!

The detailed investigation of the behavior of the model must be based on some broad theory. The theory which is in best accord with our previous experience is Einstein's General Theory of Relativity. But Einstein's equations imply that the geometrical properties of space depend upon its physical content—and that it is not necessarily the flat, infinitely extended theater of events with which we are familiar.

This opens up a new range of possibilities for our model of the universe, for although the uniformity of distribution of the ideal nebulae will induce a corresponding uniformity of the space, this space need by no means be the flat Euclidean one. It could indeed be a closed space, the three-dimensional version of an ordinary spherical surface, whose total volume is finite, and whose straight lines return into themselves as in the case of great circles on the surface of a sphere. In this case, we would truly have a finite, but unbounded universe, containing but a finite number of nebulae. In contrast with the flat Euclidean space, such a space is said to have a positive curvature

Still a third possibility is open to us — the universe could be an infinitely extended space of negative curvature, one which is harder to visualize.

Unfortunately, the observations presently available to us do not suffice to single out one of the possible solutions as uniquely representing our actual universe. Some possibilities can be thrown out as leading to too short a time since the initial explosion, but among those which remain are several which quite adequately reflect what we now know for certain concerning the nebulae.

We can confidently look forward to future observations yielding the data required to narrow down our choice—or perchance to show that none of the relativistic models is adequate to portray reality. It does appear, however, that in any case we may expect the universe to continue, and even to accelerate, its expansion. The distant nebulae will then eventually escape from that part of the universe that has any effect on us, and we shall be left with only a few nearby companions, with whom we are caught in our mutual gravitational attraction.

Is there no escape from these grim conclusions? We surely cannot, in good conscience, leave the subject without probing some of the various alternatives.

The first avenue of escape which appears to one is that possibly the reddening of light from the nebulae is due to some unknown small influence on it during its tremendous journey to us, rather than to a Doppler effect caused by a motion of the source Then, the nebulae may remain indefinitely where they are, and the degradation of the universe is one of frittering away of light rather than of loss of matter through escape. Such is indeed a possible out, but good scientific methodology demands that before we accept it some better picture—and preferably some direct confirmation — of the be advanced.

Yet another, and even more revolutionary, possibility is that somewhere in the universe matter is being created out of nothing to replace that lost in the vanishing nebulae. Such proposals have been made by several astronomers. They differ among themselves in method and in detail, but all would have the effect of creating new nebular matter—whether by the gradual accumulation of newly created gaseous matter, or by the sudden and spectacular flaring-up of super-novae, those fantastic "new stars" which are observed to occur every century or so in the nearer nebular.

These are but two of the more promising alternatives to the picture painted by Relativistic Cosmology. Which of these views of the universe, if any, will prevail is a question for the future to decide. Of this we can, however, be sure — the advancing front of science will always root out more questions than it can answer at the time, and the problem of the universe of the nebulae will be no exception to this fundamentally healthy state of affairs.

Ocean Bottom Reveals Outer Space Bombardment

Roughly. 7,000,000,000 mysterious particles from outer space bombard the earth each year This was revealed from studies made of the ocean bottom.

More than 300 of the odd magnetic particles were swept from 45,000 square miles of ocean floor by a home-made magnetic rake during the Danish Deep-Sea Expedition in 1950-52. They have been named caudaites to distinguish them from meteorites and cosmic dust.

The particles are believed to originate from the tails of the larger cosmic bodies that enter the earth's atmosphere.

Varying in color from grayish-brown to shining black, the caudaites are nearly all spheres. They measure less than one-half millimeter in diameter. Upon examination, scientists found that some *of them consist wholly of magnetite.*

Others have a silicate groundmass loaded with magnetite crystals. They also found that nearly all the particles had spherical cavities. Altogether, seven metallic particles were found in the material studied.

Support of the theory that the particles come from outer space involves several factors.

The structure and composition of the metallic particles indicate that their formation requires high heat and rapid cooling.

No comparable particle formation has been found to occur naturally on land

A comparison of the particles with iron meteorites was made from similar particles found in an 1872-76 expedition and showed that all the material found in the particles is also found in stony meteorites.

Other particles found by a Swedish expedition from deep borings into the sea bottom rule out artificial origins.

The scientists reporting the cosmic particles estimated that the total weight of the 7,000,000,000 particles falling on the earth each year would be about 30 tons.

A complete description of the magnetic particles was reported to the British journal, *Deep-Sea Research.*

IS JET NOISE Deafening?

Condensed from University of Chicago Reports

JET NOISE is one of modern technology's newest and most savage attacks on the human ear. Offsetting its effects is far more important than reducing the complaints of persons living close to jet airfields Controlling the noise is vital to that part of our national defense which is concerned with the operation and maintenance of jet planes.

Two University of Chicago scientists collaborated in the "Benox" project, which has involved a number of scholars from different institutions in the study of techniques to reduce the effects of jet noise. Ward Halstead, professor of medical psychology, conducted tests studying the actual effect of exposure to jet noise on the higher brain centers William D. Neff, professor of psychology, attacked the problems of the effect of jet noise on the hearing and of special techniques for preventing damage to the hearing

From 50 feet away, the shriek of a jet plane operating with an afterburner reaches an intensity level somewhat above the level at which there is risk of damage to the inner ear, the tests show.

In the course of operations on an aircraft carrier, for example, a large number of men are subjected to such noises for long periods of time. Preliminary studies indicate that the average hearing loss for men who have been regularly exposed to jet noise is greater than that of men of comparable age in the normal population. Conclusive evidence, however, that personnel exposed to jet noise have suffered permanent hearing losses is yet to be obtained.

THERE IS much evidence of temporary hearing loss. In some cases tests have shown that, even 18-20 hours after exposure, hearing has not yet returned to its normal pre-exposure level. While this hearing loss does not result in the inability to hear sound, it may make voices of people in ordinary conversation sound as though they were coming from a loudspeaker of very low fidelity It can also result in a ringing in the ears.

Tests conducted by the "Benox" group indicate that earplugs now available provide the maximum protection which can be expected from this type of device. A variety of these insert-type ear defenders are manufactured. All seem to be better than protectors of earmuff des
Observations made by the
group disclosed that both
and civilian personnel wor
a J-48 engine running at full

The University of Chicago Reports (Jan '55), 5801 Ellis Ave., Chicago 37, Ill

power were willing to use earplugs without special urging.

In his part of the report Neff points out that the use of the earplugs under conditions of jet noise may actually improve verbal communication. Men working in the vicinity of the jet plane where the noise levels are approaching levels of *inner-ear damage were* able to communicate by voice as well or better when wearing earplugs than when not wearing them. Furthermore, they were less likely to suffer the temporary deafness which interferes with the hearing of vocal communications during the periods of relative quiet which may come between exposures to very high levels of noise.

USING *a battery of tests, Halstead* found that there is no objective evidence now available which indicates that intermittent exposure to sound levels such as are produced by jet planes is physiologically fatiguing to military men otherwise in good physical and mental health.

He did discover that a marginal "stress" group of symptoms appears in some civilians who work without ear protection and who have responsibility for executing the critical maintenance operations on jet aircraft. *Certain tests of* higher-brain functions reflect this.

The preliminary experiments conducted by Halstead *indicate* that individuals exposed to high levels of jet noise may lose some of their ability to absorb information through the sense of touch. This could be critical, since many ground-maintenance adjustments, especially in night operations, are so made. Both *scientists believe that there ought to* be further and more intensive studies of the long-range effects of exposure to jet noise, both to the hearing itself and on brain and body function.

Uranium Found in Eastern States

The Atomic Energy Commission has had "encouraging results in finding new uranium fields in the East."

That fact was recently reported to the annual meeting of the American Institute of Mining and Metallurgical Engineers.

The AEC and the U. S. Geological Survey have undertaken a systematic exploration in New York, New Jersey and Pennsylvania, said Thomas N. Walthier. He is senior geologist of the Bear Creek Mining Co. and former staff geologist, division of raw materials, AEC.

"About two dozen uranium occurrences of some significance are known," he said. "Ten of these are located in New Jersey, six in Pennsylvania, and five in New York." Others have been found in Florida

In the eastern states, he added, the deposits resemble those on the rich Colorado plateau.—*Chicago Sun-Times*

DIAMONDS IN THE JUNKPILE

by Holmes Alexander

Condensed from The Baltimore Sunday Sun

THE WORLD'S greatest diamond hunt is taking place right here in the United States. It is not a search for new diamonds, although the discovery of such a lode would be a national godsend. Nor is it as yet a round-up of gem stones, but it might eventually become one. Primarily the big hunt is for industrial diamonds which have literally vanished in the form of dust and trash.

Some of this invaluable refuse has been thrown into the city dump Some has been smuggled abroad to Russia. Some refuse is still lying in the junkyards of factories.

All told, about 33 million carats—more than twice the world's annual output — are unaccounted for. We imported that many carats during 1930-50, mostly for use in World War II, and with a little thrift we might have saved perhaps half.

Diamonds never wear out. When a diamond is used for drilling or grinding, it sometimes fractures, but oftener it merely slips its moorings or becomes imbedded in softer parts of the tool. The tiniest diamond particles are still useful in industry, and that's why the government maintains an intense campaign of recovery. It hopes to stop the appalling waste and, if possible, to regain several million carats of what is just about the most critical raw material in the defense program

Diamond dust looks like tc powder. Most of it is made b, ing boart. Boart is a mixture sisting of diamond fragments, or perfectly crystallized or

The Baltimore Sun (Mar. 27, '55), Baltimore 3, Md Copyright 1955

monds, and 95 percent of it comes from South and West Africa. You can hold a pound of boart in your cupped hands, and a pound is worth about $5,000 on the open market in New York. On the domestic black market, boart may bring two and three times that price, while on the Red market, the sky's the limit.

The State Department knows that diamonds are getting through the Iron Curtain, both from our ports and from foreign cities. In Brazil last year, Communist agents were outbidding American buyers by six dollars to one.

We needed diamonds during World War II, but now we just can't do without them We have converted so much heavy industry to diamond-tipped tools and diamond-dust abrasion wheels that there is no turning back.

The Critical Materials List, compiled by the Defense Department, carries 70-odd items along with their satisfactory substitutes, if any—but the list gives no substitute for diamonds The next best material for diamond work is silicon carbide, which sells at a trifling 16 cents a pound But industrialists won't touch it One of them says:

"If we went back to these older methods, we would double our man-hours and turn out inferior products."

It takes diamond dust, impregnated in grinding wheels, to sharpen cemented-carbon tools that cut high-grade steel. It takes diamond-studded bits to dig for uranium ore. Without diamonds we cannot keep pace with the schedule for jet-engine production and armor-piercing shells. Only by boring .0003-inch holes in diamonds can we make the dies for the fine wiring that goes into radar, bombsights, gunsights, binoculars, compasses, gauges, magnetos, dynamos, electric motors, pistons, crankshaft bearings and other necessities.

Today we are importing about 12 million carats a year for industry, but we are using 15 million carats. Entirely aside from current consumption, the Defense Department is desperately trying to maintain a two-year stockpile just in case our imports are cut off. There are several wheel-making firms which could use three times their allotment of boart and at times the delivery of diamond-tipped tools runs 84 weeks behind the orders.

Buying isn't all that the government is doing The Customs Bureau is chasing smugglers who bring $2 million worth of diamond gems into the country every year. Usually such forfeited gems are put up at public auction, but lately they have been turned over to the stockpile. In effect, the government is paying gem-prices—about $500 a carat—for industrial stones. That's how much we need them.

Diamond hunger is sweeping the country and the world. Government enforcement people are encountering a new kind of precious-stone thief, the black marketeer and the Red courier.

Stones and dust are all too easy to carry. It's simple to do business out of a briefcase. A firm is supposed

to report any diamonds it buys above the ceiling price, but inspectors say that such reports are almost never made and that there are numerous violations.

It's the old story of government controls and widespread non-compliance. The big firms always have their supply sources, but small companies often have to buy under the counter or not at all.

"We can generally catch the big operators," says a government sleuth, "but it's the fellow with only $5,000 or so of stones who gives us trouble. He peddles to industrial buyers and it's almost impossible to get a tip-off on dealers like him."

Still harder to nab are the export smugglers, the ones who start diamonds through the Iron Curtain. Some of this work is done by diplomatic pouch, a method that the State Department can't stop without causing an international crisis.

The Commerce Department, which has charge of outgoing materials, suspects that diamonds are leaving the country in the pockets of fellow-traveling sailors, airmen and tourists, but few arrests are possible.

Where agents do put the arm on illegal diamond movers, it is by discovering faked uses of the export license. The law allows 21,000 carats a quarter, in various forms, to be shipped abroad but only to friendly nations and for specified purposes. Double-checks, however, show that some of the material gets transshipped to East Europe.

The diamond hunger, of course, has other aspects. It has created, in the past couple of years, a new American business — that of reclaiming diamond dust. There are not more than nine well-known reclaimers in the United States today, and they keep their processes secret.

They buy up old or broken abrasion wheels, or obtain them on consignment, and separate the diamond flakes which have been driven into other materials of the wheel. The reclaimers also buy "sludge," the residue that falls from wet-wheel grinding, and "swarf," the dry-wheel waste material. They are redeeming 15 percent of the diamond dust from sludge and 75 percent from swarf.

Ordinarily a reclaimer doesn't even let his own workmen know all his methods. The final separation work is done by the boss himself behind a locked door

More startling still are the man-made diamonds exactly like nature's own that have been turned out on a giant press at the General Electric Research Laboratory in Schenectady, N Y. A scientific dream come true, they offer a new home-grown supply of diamonds vitally important in industry and national defense.

Their cost (hundreds of thousands of dollars if all expenses of four years of research are included) prevents them from being a threat, as yet,

• The steadily rising tide of technical knowledge has a way of obliterating obstacles so effectively that what seemed impossible to one generation becomes elementary to the next.

—Arthur C. Clarke

the value of natural diamonds, but costs will come down in time.

The great diamond hunt is surely one of the strangest quests in history. For there are plenty of diamonds where the others came from. While we are panning the junk heaps, there are tons of diamond deposits within the free world's orbit and practically none inside the Iron Curtain. The Belgian Congo, which exported 12,000,000 carats last year, has reserves of 200,000,000,000 carats. With American mining methods, we could have industrial diamonds running out of our ears and still not upset the [illegible]

Consolidated Mines, Inc., and its subsidiaries.

American government officials, particularly in the State and Justice Departments, become infuriated at the very mention of the syndicate. Their indignation is only incidentally connected with the present world crisis. In 1945, before we ever dreamed of mass rearmament, Attorney General Biddle brought an antitrust suit against DeBeers, but the case had to be dropped for lack of jurisdiction.

Almost equally incensed at the cartel are some American big businesses. During the Marshall Plan period, with its two-way flow of government money, great pressure was put upon the State Department to get rough with DeBeers. The syndicate is incorporated in the Union of South Africa but has its main offices in Britain. But both the mother countries and the outlying dependencies resisted our power of the purse. DeBeers is too big a taxpayer to be offended by the British and Belgians. Besides, the Belgian government is a 50-percent stockholder in the Congo mines.

Next, there was some effort to get African mining companies to cancel their contracts, or not to renew them, with DeBeers. We could pay double the current price of diamonds at the minehead, and still save money by rubbing out the brokerage fees.

One American firm offered a deal to buy up the "tailings"—or slag pile—of the great Beceka Mine in the Congo, a haul estimated to contain 10 million industrial carats. Some other American hustlers were willing, with Marshall Plan funds, to move machinery into Africa and bring out enough diamonds to last us for 50 years.

But all the overtures failed. We did manage to get some tentative promises from Dr. John Williamson, the diamond king of Tanganyika, but nothing has come of it yet. We were able to give $2.2 millions of Marshall Plan equipment to French Equatorial Africa and to get purchasing rights there, but the estimated annual yield is under half a million carats.

What can be said for the syndicate's position?

To begin with, Sir Ernest Oppenheimer, head of DeBeers, didn't get where he is by having panicky nerves. At 75 he's been through world crises before and, like most Europeans of the old school, he doesn't share the

New World's horror of monopoly.

During World War II, when wide use of industrial diamonds really began, he made available his entire stock of industrials at 56 cents a carat. At present, along with the annual 12 million carats, he's also selling to the American stockpile, on the promise that this extra amount is kept off the commercial market.

Most important of all, he's using his position to see that none of his sources flow to Russia. Actually, the syndicate is the main reason why Russia can get diamonds only through her smuggling ring.

The present attitude toward the cartel is as traditional as our dislike of monopoly: "If you can't lick 'em, join 'em." Some attempt, not yet fruitful, is being made to place an American on the DeBeers board of directors, which consists of seven Britons, three Belgians and one Portuguese. Mainly, however, the conciliation takes the form of saying only nice things about the syndicate. For instance, a survey of the industrial-diamond shortage, written by a Library of Congress researcher for a Senate committee, devoted less than 1 of its 62 pages to the cartel.

The summary noted with infinite politeness that:

"This diamond monopoly is characterized by the somewhat inflexible prices asked by the DeBeers production group; the slight variance in prices usually tends to be upward."

But the price facts are that boart was still 56 cents a carat when World War II ended; it went to $1.80 when the Korean War began and is $2.82 at this writing—an emergency-period upsweep of nearly 300 percent.

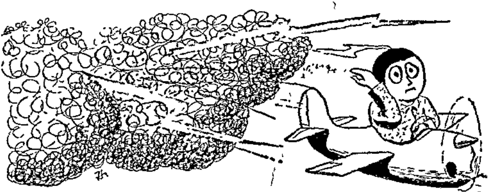
The big story of diamonds, of course, is one of paradox. The tail of a luxury product is wagging the dog of industrial progress. DeBeers is in the business of selling gems, and the value of gems is based on their scarcity. If it weren't for humanity's fancy for glittering jewels, there wouldn't be such difficulty about getting this mineral for the factories.

Yet it's hard to imagine that the new diamond hunger can be satisfied without devouring the whole diamond trade. This won't happen tomorrow, but it's in the cards. The world can no longer live without diamonds, and the history of hard-pressed countries is that utility wins out over beauty and luxury.

Mussolini made the Italian women throw their wedding rings into his war chest. Russia, Germany and Japan all confiscated diamonds during the last 30 years.

There is not the remotest likelihood that the American government will call in or would even accept the small fistful of industrial dust which all the gem diamonds in America would bring. But the fact remains that jewel merchants have begun to reclassify some of the smaller stones as industrials.

For the diamond demand is not entirely a war phenomenon We need diamonds to build the world's dams and highways; to turn out farm machinery and all forms of transpo tion; to realize new possibiliti electronics, ceramics, coal-m water-prospecting and surge



Can Cloud-Seeding Stop Storms?

by *Waldemar Kaempffert*

Reprinted from The New York Times

FROM January to April, 1953, and from December, 1953, to April, 1954, planes directed by Dr. Jerome Spar of New York University seeded clouds by dropping 30 tons of dry ice between Florida and Massachusetts. Additional seeding was carried out from the ground with silver iodide from 17 generating stations between Florida and New York.

The purpose of the test, carried out at the request of the Office of Naval Research, was to find out if cloud-seeding could make, break or change a storm in a big way, as some maintain. Dr. Spar found no evidence that seeding has any large-scale effect.

Seeded and unseeded areas were compared. In 18 cases there was seeding, in 19 (controls) none. The selection of areas for seeding were made at random by the Office of Naval Research.

IN the first winter's seeding, three planes flew parallel tracks, 100 miles apart and 1,000 miles long. Only one plane flew over unseeded areas, dropped no dry ice but made meteorological observations for comparison with others made during seeding. In the second season, planes flew in up-and-down target areas approximately 500 miles long.

Each plane on a seeding flight during the first winter carried 1,000 pounds of crushed dry-ice pellets dispensed at the rate of 1 pound a mile. The plane load was increased to 2,500 pounds the second season, and the rate of dispensation to 5 pounds a mile.

In the ground experiments the generators burned for 12-hour periods and sprayed a solution of silver iodide which cool air condensed into tiny crystals.

In many cases seeding planes flew under the worst possible conditions.

There were icing and high winds. On one mission a seeding plane was so heavily iced that it was out of control until it lost altitude and hit a layer of warm air.

THE RESULTS of the experiments had to be compared and statistically evaluated. Would there have been rain or snow, clouds and winds in an area whether or not it was seeded? Statisticians calculated the probability with a high degree of accuracy. On the basis of such statistical analyses Dr. Spar and his colleagues concluded that the recorded differences would probably have occurred had there been no experiment.

The negative finding of the project does not exclude the possibility that cloud-seeding may have local effects, says Dr. Spar. The experiment was limited to possible large-scale effects.

New Proof That Germs Invade Teeth

New proof that tooth decay is primarily a bacterial disease has been discovered by a team of scientists from the University of Chicago and the University of Notre Dame

The studies implied that a streptococci can cause tooth decay in rats. How many other microorganisms can also be responsible—out of the hundred or so found in the mouths of animals—will require further investigation.

Previous studies on rats grown in the unique germfree chambers of the Lobund Institute at Notre Dame had shown that rats free from bacteria did not develop tooth decay, even though they were fed a diet known to encourage tooth decay in non-germfree rats

In the present experiments, one group of rats grown from birth in the germfree environment had their mouths swabbed with enterococci, a comman group of the streptococcus family, and one other bacterium.

Another group of rats was raised in a normal, germ-laden environment. Both groups received the same diet known to cause tooth decay in rats.

The rats with normal mouth germs developed serious tooth decay. And the inoculated rats in the otherwise germfree environment were found upon examination also to have developed typical symptoms of decay.

Bacterial examination showed the enterococci to be the predominant organism while the second organism could only rarely be found After the rats were killed, microscopic photographs of slices of the teeth showed that only the enterococci had deeply invaded the decayed areas

The rats developed decay up to an age equivalent to a human age of 20 years. This decay was produced in spite of the fact that the rats were not exposed to the acid-producing lactobacilli, the germs most commonly thought to be responsible for decay.

The average human mouth, the investigators indicated, may have a hundred or more different forms of bacteria. The Chicago and Notre Dame scientists point out they are still a lo way from an immediate practical a to the prevention of human tooth

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IMPROVED TEST FOR PREGNANCY REPORTED

A pregnancy test said to be "rapid, economical and highly accurate" is reported in the *Yale Journal of Biology and Medicine* by Drs. Edward H. G Hon and John M. Morris.

The test uses the common American toad. The time required to find out whether a woman is pregnant is only 4 hours, or less.

They claim 100-percent accuracy in the diagnosis of normal pregnancy in some 2,000 cases Other pregnancy tests, such as the Friedman test with rabbits and the Aschheim-Zondek (A-Z) test with mice are highly ac-

curate but require from 48 to 96 hours for an answer.

All of these pregnancy tests, including the Yale test, depend on finding in the urine a certain hormone, chorionic gonadotrophin, which originates in the placenta.

A concentrate prepared from the urine specimen is injected in the test animal. The hormone, if present, will cause a definite reaction.

PRUDERY A BAR TO CURE OF PATIENTS

The reluctance of patients to report the first signs of illness to their

J. Cantor of Flushing, N. Y. The body, he says, is still thought of as "naughty."

"Is it desirable in the interest of delicacy," he asks, "to delete all discussion of the intestinal tract and then to have people die from cancer of the rectum, which could have been discovered and treated successfully, if they had only known a few simple facts and been able to discuss them with their doctor?"

Doctor Cantor praised the progress that has been made in the free discussion of tuberculosis, venereal disease and sex physiology.

MEASLES AND GAMMA GLOBULIN

Should infants and children who have been exposed to measles be given gamma globulin or should they be permitted to develop the disease?

A consultant writing in *The Journal of the American Medical Association*, says this:

If the baby has been exposed to measles and the mother has never had it before, gamma globulin should be given.

If the baby is less than 4 months of age and the mother has had measles, gamma globulin is not nec-

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by Arthur J. Snider

essary because the child will have inherited an immunity that will last for about the first 6 months of life.

Between ages of 4 months and 2 years, it is advisable to give gamma globulin immediately because statistics show most deaths from measles occur under 2.

If a child is more than 2 and in good health it is not advisable to try to prevent the disease. However, it is desirable to lighten the attack with gamma globulin. This is done by waiting 5 or 6 days to allow the measles virus to incubate.

UNSOLVED PROBLEMS IN TUBERCULOSIS

While the advent of drugs has reduced the death rate from tuberculosis by 70 percent in the last 10 years, there are serious problems still to be met if the disease is to be conquered, *according to* Dr. Edward T. Blomquist, chief of tuberculosis control for the federal government

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devastation if the reservoir is not removed.

The trend toward treating tuberculosis at home means that many cases are not being reported to health departments. Many are thus only receiving intermittent care.

Catching up with the recalcitrant patient, the migrant laborer, the immigrant from areas where there is much tuberculosis, and the economically submerged patient poses problems of grave consequence, according to Dr. Blomquist.

ADVOCATES LONGER HOSPITALIZATION

The increasing trend toward cutting down the length of hospital stay following delivery of a child is causing an increase of ailments years

later, Dr Jacob Reichert of Phoenix, Ariz, reports to the International Academy of Proctology.

There are more complaints being heard as a result of stretched and dislocated muscles following childbirth failing to return to normalcy because of too rapid resumption of full activity at home, he says.

COUGHED AIR MOVES SPEEDILY

When you cough, you move air through your windpipe at the speed of sound. By the time it gets to the level of your throat, however, the air speed has dropped down to ab 100 miles an hour and by the ti is blowing out of your mouth moving at only 15 miles an ho

Doctor Benjamin Ross of the University of Oregon, Portland, reported these findings before the Federation of American Societies for Experimental Biology. Studies were made with the aid of an X-ray motion-picture camera taking 60 frames a second and a flow-meter placed at the mouth to measure the amount of air coughed out.

CANCER NOW STRIKES ONE IN EVERY FOUR

As a result of the growing number of older persons in the population, cancer will strike one in every four Americans rather than the present estimate of one in five, according to the American Cancer Society.

This means that 40 million Americans now living will at some time in their lives have cancer

About one-fourth of those afflicted now survive the disease The ACS believes that twice that many would be saved if knowledge already at hand were universally applied.

The ACS, in its annual report, says

that lung cancer is "*increasing* markedly and very rapidly." However, it is the only form of cancer which shows so definite a tendency.

In the last 20 years, death from lung cancer in women has increased over 200 percent and in men, over 600 percent.

RUNNING NOSES DRIED BY HYDROCORTISONE SPRAY

Use of hydrocortisone spray to stop continuous sniffles and dry dripping noses of hay fever sufferers is reported by Drs. John H. Burger and Joseph H Shaffer of Henry Ford Hospital, Detroit.

They told a conference sponsored by the New York Academy of Sciences that perennially running noses were dried up in 86 of 100 patients. By way of comparison, an inert spray was given to these patients on alternate months. Only 7 reported improvement.

Doctor Ben H. Senturia of St. Louis said a combination of hydrocortisone and the antibiotic, neomycin, has been sucessful in clearing up ear infections after operations.

DEVISE BLOOD TEST FOR "NERVE GAS" POISONING

It is possible to tell whether or not an individual has been overexposed to nerve gas, the fearsome war weapon, or to a chemically related insecticide, by measuring the activity of an enzyme, cholinesterase, in the blood, according to Dr. Wendell T. Caraway, biochemist in the Rhode Island Hospital, Providence.

VIRUS ISOLATED IN HODGKIN'S DISEASE

A possible clue in the search for the cause of Hodgkin's disease, a form of human cancer attacking the lymph glands and spleen, is reported by the University of California pathology department.

A virus, not identified before, has been isolated from tissues affected

by Hodgkin's disease. Dr. I. H. Perry of San Francisco said it is being studied in the hope that it may be related to the disease.

Search for an infecting agent in Hodgkin's disease has been carried on for many years but results to now have been negative.

HEAT EXCHANGER FOR BLOOD TRANSFUSIONS

A method for warming blood before it is transfused into babies afflicted with the Rh blood factor has been devised by General Electric Corp.

The blood-warmer, a heat exchanger, was the result of a suggestion of Dr. Stewart C. Wagoner, Schenectady pediatrician, who felt that the cool temperature of refrigerated blood might be causing fatal shock in some of the infants

In 20 cases of blood transfusion now carried out by Dr. Wagoner, there has not been a fatality. The blood is passed through a small-bore heat exchanger — a tube within a tube—before it enters the patient.

DESTROYING TUMORS WITH ATOMIC BLASTS

A method of treating brain tumors by exposing patients directly to the rays of an atomic pile is being studied by doctors at Massachusetts General Hospital and Harvard Medical School.

Such an idea was tried three years ago by Dr. William H. Sweet on a dozen hopeless patients. They were injected with boron. As the atoms of boron were split by the slow neutrons coming out of the pile, much of the brain tumor was destroyed. But the number of bombarding neutrons could never be raised to the point of offering hope of complete tumor destruction.

The idea is being revived because an improved reactor opening has been installed. The atomic pile emits through it 20 times as many neutrons as the former equipment.

There must be several tests made before hopeless patients will be considered for experimental treatment, the Boston doctors said.

VICTORY OVER POLIO IS NOW IN SIGHT

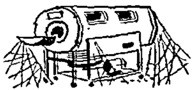
The doorway leading to the elimination of paralytic poliomyelitis as an epidemic disease has been opened by the discovery of a vaccine described as effective and safe.

Developed by Dr Jonas E. Salk, University of Pittsburgh, the vaccine was declared to be 80 to 90 percent effective in the 1954 mass trial, the largest medical experiment in history.

Doctor Salk has revealed an even more potent vaccine is at hand and that theoretically, a permanent immunity can be achieved by a series of primary inoculations followed by a booster dose.

The new vaccine promises to consign polio to the same relative o

scurity as diphtheria, smallpox and whooping cough. There will continue to be isolated cases of polio, doctors believe, because all persons will not choose to be vaccinated. But chances for an epidemic will be slight because the chain can be broken by the bulwark of the millions of children who are now being vaccinated.



The Salk vaccine is unusually safe. There were only four children in every thousand vaccinated who had any "minor" reactions such as fainting, nausea, dizziness or slight rash.

Only 4 children in every 100,000 had "major" reactions, such as severe rashes, high fever or severe pain in *arms or legs.*

Development of the Salk vaccine climaxes 17 years of organized research directed by the National Foundation for Infantile Paralysis.

The first major milestone came in 1949 when Dr. John F. Enders of Harvard found that polio virus could be grown in cultures of non-nervous tissue. This paved the way for a safe vaccine.

The next important development came in 1951 when it was determined there were only three types of virus that caused polio. Then, in 1952, Dr. Dorothy M. Horstmann of Yale University and Dr. David Bodian of Johns Hopkins upset an old belief that the polio virus went directly into the nervous system.

They found that it remains for several hours in the blood stream. This meant there was a time and place where and when the virus was accessible and vulnerable to preventive measures.

The final important step came in 1953 when mass field tests using gamma globulin were held in Utah, Texas and Iowa. The gamma globulin, obtained from blood of persons known to contain polio antibodies, conferred protection of from six to eight weeks.

With all of this knowledge behind him, Dr. Salk was encouraged to proceed in developing a vaccine that would stimulate the body to develop its own antibodies.

The 1954 trials involved some 1,800,000 school children. About 440,000 received the vaccine and 210,000 a placebo—a substance that looked like the vaccine but was known to have no effect.

ATOMIC ENERGY FOR STERILIZING BONE

Attempts to sterilize bone by freezing, boiling, and use of antiseptics or antibiotics have not proved entirely satisfactory. The bone may continue to harbor living bacteria and viruses and thus would not be entirely safe for transplant surgery.

University of Michigan scientists have found that radioactive cobalt will make bone bacteriologically sterile and not greatly alter its ability to "mend" or stimulate new bone formation.

The tests thus far have been confined to dog bone.

TRUTH ABOUT VIOLENT INSANITY

by Dr. Edward A. Strecker

Condensed from a chapter of the book, Basic Psychiatry

BY FAR AND AWAY, the most interesting manic-depressive patient I ever knew was Elizabeth T., whose illness began with depression at the age of 18 and continued without interruption until her death at the age of 54. It was a beautiful case for study, since once the pattern of the psychosis was established, excitement and depression followed one upon the heels of the other, each phase lasting almost exactly 28 days

Furthermore, I shall always remember Elizabeth because she almost killed me. Because of an old kidney impairment, the patient had a blood pressure of about 160, continuing at that level during the depressive phase. I noted that during the excited months the pressure was constantly above 200, and often as high as 250 or higher. I posed myself this question: "Does the blood pressure go up first, or only after the symptoms of the excitment have appeared?"

To find the answer, I sat up with Elizabeth one of the nights when she was due to change from depression to mania, taking the blood pressure every 15 minutes. The patient was quiet, felt "miserable and unhappy," answered questions slowly, with few words, but intelligently enough. The blood pressure remained evenly between 163-165.

Suddenly at about 3 A.M. the pressure jumped to 255. I removed the apparatus, and looked at Elizabeth. Still quiet, she looked at me, perhaps a bit fixedly. The next thing I knew she had the fingers of both hands around my throat and was vigorously choking me My head began to swim, but I managed to hook one foot around the only piece of movable furniture in the room, a metal bedstand, and succeed in overturning it.

The crash attracted the attention of a nurse. She took one look and then came back with reinforcements. The nurses, three of them, managed to unhook Elizabeth's fingers from my throat, but not before my face was livid and my eyeballs starting from their sockets.

During her depressions, Elizabe answered questions in monosylla and day after day sat slumped chair, scarcely moving, de

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with deep-furrowed brow and drooping mouth.

As excitement supplanted depression, Elizabeth could be scarcely recognized as the same woman. In an hour she looked ten years younger, rosy-cheeked, healthy-looking, active, but a very hurricane of misdirected energy. Constantly talking, screaming, dancing, singing, profane, obscene. In behavior, she was unpredictable, excepting that she was certain to misbehave.

A favorite pastime of hers was to smear her face and body with lipstick, adorn herself with a headdress made of grapefruit rinds and bits of cloth, tie red rags around her arms, legs, bust and pelvis and shout and sing at the top of her lungs—"I'm a copper-colored maid . . ."

merging into another on a mixing screen. Often a chance remark from a nurse served to turn a good-tempered, laughing woman into an infuriated animal — trying to scratch, kick and bite, in the meantime hurling a verbal spate of coarse abuse and threats of violence. If thwarted in her desire to injure the nurses, she vented her destructiveness upon the furniture, dishes, panes of glass, anything at all she could break.

During the periods of depression she could not remember what happened during the excited periods, but from excitement to excitement she clearly recalled her behavior and boasted of it.

These are a few of the facets of the psychotic life of Elizabeth T. She taught me much psychiatry. I am sorry I could not do more for her.

Naturally, not every manic-depressive patient is as severely sick as was Elizabeth. The majority are not. There are innumerable gradations, from mild depression easily mistaken for a normal "blue spell" to the depths of agonized mental suffering; from slight overactivity in thought and word which might lead to the opinion, "He is certainly a lively fellow, interested in everything," to uncontrolled, unmistakable mania.

On the basis of returns from public mental hospitals alone, there are about 40,000 manic-depressive patients in the hospitals, and each year 11,000 more are admitted.

There is an analogy between the natural weapons animals use when their lives are threatened and the psychological defenses of human beings when they are faced with the danger of psychological destruction. The heavy-weight animals, huge beasts like the elephant, meet the life threat by a head-on charge, attempting to demolish it.

The manic-depressive patient, certainly in the excited phase, acts rather like the heavy-weight animals, putting out a heavy barrage of words, emotions and physical activity. In

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their uninhibited activity, manic patients are likely to bruise, abrade and lacerate themselves. Manic patients, too, mischievously and depressed patients, often with suicidal intent, try and sometimes succeed in swallowing all manner of things. I have the photograph of a collection of 32 articles removed by operation from the stomach of a depressed patient—pins, needles, nails and bolts, screws, hairpins, corset stays, etc.

By and large, notably in the active or manic phase of the psychosis, the metabolism or general energy of the bodily functions is at a high level. Literally everything, the heart and circulation, the breathing, the appetite, digestion and bowel function, the muscles, the skin, all are stepped up and working at the peak. Perhaps in 24 hours this same patient may pass into the contrasting or depressed phase.

> • Behind his civilized veneer, man harbors in himself an asocial nucleus more destructive than the atomic nucleus which he has recently put into the service of his own destructive purposes.
> —Franz Alexander, M. D.

While I have seen it many, many time, I am still amazed at the physical transformation, almost transmutation, that takes place in patients who pass into the manic from the depressed phase The sallow skin, the bent-over carriage, the dull eyes, the seeming physical weakness, almost decrepitude of muscles, are swept away and replaced by a healthy, glowing skin, erect, ener-

[illegible]

more seem to have been dropped from the patient's physiological age.

These observations lead me to suspect that a "magic"—the scientific magic of bodily chemistry—may be a factor in manic-depressive conditions. How else explain this passage from one phase of the disease to its direct contrast, sometimes in a few hours? I knew a lady who had at least 50 brief attacks of acute, violent mania. Frequently she would come to the hospital in a cab, seek me out and, with complete control of her thinking and behavior, say, "Doctor, take me in at once, have me sign the necessary papers, put me in the acute ward, for tomorrow I will be in a terrible condition."

"How do you know?"

"I feel it. I am sure."

Always her prediction came true. The next day found her in "terrible condition," often homicidal.

The inheritance factor also is present in manic-depressive psychosis, though at this time no one can be sure how heavy it is. I have the record of the wife of a very intelligent and prominent executive, who after the birth of each one of her three children had to be treated in a mental hospital for severe manic-depressive attacks Each of her three children, throughout their lives, had a malignant form of the same psychosis—so-called "circular insanity" in which there are practically no symptom-free intervals.

Such a prominent inheritance tern is unusual, but it is not un

for a manic-depressive patient to have a history of the psychosis in one or the other parent. Incidentally, each patient with manic-depressive tends to establish an individual pattern of frequency and duration of attacks One of the more disheartening aspects of the psychosis is the almost fatal tendency for attacks to recur.

On the other hand, a person may have only one or perhaps two or three depressive or manic episodes, perhaps less than a year's total illness in a lifetime, and still be truly manic-depressive. I knew an engineer who had two typical but brief depressions, one as a young man, the other at the age of 50, nothing more. Otherwise his life was fine and constructive. Among other inventions he worked out a chemical process without which it would not be possible to carry on one of the nation's basic industries.

Preponderantly, the manic-depressive patient tends to have a body formation called pyknic. Briefly, he is prominent in his girth measurements, short, thick-necked, powerful muscularly Inside that big-chested, strong, energetic body, there is the driving engine of a powerful heart and adequate blood vessels. The glands of internal secretion — the thyroid, pituitary, sex glands, etc.— are dynamic. The body exudes driving force.

The pyknic is fairly likely to be an extrovert. The pronounced extrovert is a doer, an eager and bustling "go-getter." At his worst he is "the life of the party," his tongue is multiple-jointed and his conversation runs on endlessly.

It is true, in my opinion, that the majority of candidates for manic-depressive conditions come from the ranks of the extroverts. But before the equation is completed, long before the portals of the psychose swing open, several "x" quantities must be added. The behavior may become so pronounced in the direction of overactive, somewhat uncontrolled conduct, moodiness, depression, that the psychiatrist, fairly enough, may envision the danger of mental illness. Yet these tendencies may go no further, and the threat may be turned back.

What are the manic-depressive patients trying to do—either in the tremendous emotional-verbal-muscular activity of the excited phase or in the contrasting depression?

Sometimes in acute mania, seemingly the explanation is simple, a compensation for unconscious inner inferiorities, sharply pointed by rebuffs from the environment.

A big-brained, but physically weak, puny, non-muscular college professor frequently had brief attacks of mania during which he tumbled about awkwardly, turning pitifully ungraceful somersaults and loudly proclaimed himself, "The world's strongest man and greatest acrobat." He had had only one love affair in his life, a deep and serious one for him, which came to an inglorious anticlimax. The young woman broke off the engagement.

Another patient, in her manic attacks, was always the "world's great-

est soprano," singing away hour after hour, in a mental hospital, in her psychosis holding thousands enthralled by the "liquid magic" of her voice. This young woman's voice had shown much promise. She had spent all her savings and all she could borrow in having it trained. Then came the public recital. She was a complete failure. Her teacher advised her to abandon her ambition of a professional career.

The manic-depressive condition, in its manic exhibitions, is much more intricate than merely acting out consciously unattainable wish fulfillments. It would seem that the purpose of the pyrotechnical display of word and act, with the rapid-fire emotional accompaniments, is to throw a camouflaging smoke screen, not only between the patient and his environment, but also between the ego of the patient and the hidden mental conflicts deep in his psyche, which he cannot face. Obviously he is running away from something frightening and the manic phase has been called "the flight into reality." The behavior of the patient, often in high good humor, may seem "funny" but it is tragedy and not farce.

Perhaps one sees something similar, but very much reduced in size, when sometimes in a social conversation an apparently casual remark probes some hidden sore place in the psyche of one of the group and he or she initiates a rapid-fire conversation about a totally different subject, an almost desperate attempt to throw a diverting red herring in the conversational pathway.

What about the depressive phases of the psychosis? Freud made an interesting comparison with normal grief and mourning. But in normal sorrowing, perhaps for a beloved one removed by death, eventually new love attachments are made or old ones are strengthened. The severed reality threads are gathered together and re-tied. But in the pathological depression of the manic-depressive, the binding threads remain severed.

The manic-depressive may be and often is very sick mentally, sometimes fulfilling the traditional concept of the raving lunatic, but his emotions, thoughts and physical activity are kept fairly well strung together. In other words, if his thoughts are pleasant or angry, he acts them out emotionally in facial and bodily expressions of pleasure or rage. Should his thinking be melancholy, he is apt to show plainly sadness, dejection, remorse for his "sins" and is often suicidal.

The manic-depressive embraces the environment, is stimulated by it, draws it into his psychosis and utilizes it in acting it out He is apt to keep a finger or two on the facts of everyday life. Usually the door to his reality is kept, at least slightly, ajar.

Better understanding and modern treatment have made manic-depressive a far less inflexible psychosis. Electroshock and skillful psychotherapy have a good chance of breaking into the recurring pattern of citements and depression. My searches would seem to indi among other things: (a) that a

number of Jewish and Irish patients recover; (b) that when the onset occurs before the age of 30, the outlook is better than if later in life; (c) that the sounder the ancestry and the more normal the personality before the psychosis appeared, the better the likelihood of adjustment; (d) that serious heart, blood-vessel and kidney complications may interfere with recovery.

Every patient is a problem in internal medicine. For instance, obstinate constipation may readily occur in manic patients, far too busy with other matters to visit the toilet.

"Keep up the nutrition of your mental patients." Glibly said by teachers to students, but not so easy to attain. The excited patient is usually far too busy to want to stop for food or else often he may consume it in enormous quantities and at such express-train speed as to defy every dictum of digestion. The really deeply depressed patient never wants to eat. Perhaps he may be too unhappy and slowed up to make the smallest effort. Or he may feel too "unworthy" to partake of food.

There are auxiliary treatment factors which not only may help nutrition, but also influence the mental reactions — occupation, calisthenics, walks, outdoor and indoor games, amateur theatricals, group singing, dancing, the theater, movies, etc. These are healthy symbols of activity and perhaps they diminish the distance between the unreality of mental illness and the realities of everyday life. They may often serve to turn the destructive activity of the manic patient into useful and acceptable channels and win the depressed patients from their lethargy.

Clocks Wound Just Once in Lifetime?

If you had a clock that needed winding only once in a lifetime—on what day would you wind up winding it up?

At the rate horologists are going, we may find ourselves in this which-day-to-wind dilemma before we know it, according to *Steelways*, official magazine of American Iron and Steel Institute.

Just remembering to wind today's 400-day clocks can be tough. An absent-minded owner, says *Steelways*, returned one to a store recently because it had stopped running in only a *little over a year*. Less forgetful clock fanciers earmark anniversaries as W-Day.

Now clock makers have come up with a new model that runs for three years without winding The answer to how a clock can store enough energy to run that long lies in fine power springs of high carbon steel plus ingenious ways of holding them in check Uncoiling is governed by a pendulum that circles left and right in a horizontal plane Where an ordinary watch ticks and tocks 300 times per minute, this pendulum makes only about 6 to 10 oscillations. A spring of special nickel-alloy steel compensates for temperature changes. The first successful suspension spring of this type for 400-day clocks was introduced by the Horolovar Co, in Bronxville, N. Y.

Don't let words trick you

by Wendell White

Associate Professor of Psychology, Minnesota University

Condensed from a chapter of the book, Psychology in Living

THROUGHOUT the whole realm of human relationships there are unprincipled individuals who, by the misapplication of information regarding human nature, cunningly victimize other persons.

One can be safeguarded against the wiles of designing persons by being informed as to the means by which human behavior is influenced. Such information enables one to analyze the methods of others and detect selfish motives that may lurk behind intriguing language or half-truths.

Psychology in Living, copyright 1955 by Wendell White and published at $4.50 by The Macmillan Co., 60 Fifth Ave., New York 11, N. Y.

Most people are skeptical of ideas that they recognize as coming from someone else. But if they can be convinced that they once accepted the idea, or its underlying principle, they lose their skepticism. Adherence to an idea simply because it in some way or other got into the mind is suggested by the fact that many people accept as general principles such contradictory sayings as:

"You can't teach an old dog new tricks."

"A man is never too old to l

"Out of sight, out of min

"Absence makes the heart grow fonder."

"He who hesitates is lost."
"Look before you leap."

• • •

A cunning person frequently makes a statement so as to lead you to infer another idea which he intends you to accept, but which he could not present directly without arousing your resistance. The first statement in each of the following paired statements says something directly; the second statement expresses what the naive person would infer from the first statement but would doubt if it were expressed *directly:*

"We sell for less."
What they sell is just as good.

"What a whale of a difference a few cents make!"
What they sell is better.

"Accept no substitutes."
Theirs is the best.

"Compare the values."
Theirs is the best for the money.

"Read what leading critics say."
Leading critics say it's good.

• • •

In advertising campaigns, statements are often made for their implied meaning that great demand exists for what the person making the statement aims to promote:

"Since only a limited number will be admitted to the ballroom, you are urged to make your reservations early."

"To meet the constantly growing demand for———. . . ."

"Doesn't the opinion of hundreds of women count for anything?"

"Enrollment will be limited to——"

"Because of the insistent demand of many people that I do so, I have decided to become a candidate for . . ."

• • •

Getting the individual to infer that *great demand exists for a certain* thing is also effective because of the strong tendency to conform to the opinions and actions of others.

Getting others to infer that an idea is favored by a single person of prestige is frequently effective for similar reasons.

Another subtle trick consists in getting the individual to commit himself favorably on a proposition, or on some aspect of it, before asking him to act upon it. After he has once committed himself [illegible] he is in [illegible] ing of a sale. An automobile salesman may say, "You like the body lines, don't you? Isn't this new feature a wonderful improvement? You noticed the upholstering, didn't you?"

In a political campaign, the voter is given a button for the lapel of his

coat. If he is an undecided voter, he may accept and wear the button for no particular reason. But in wearing it he becomes a standard-bearer for the party, which he may later support to be consistent. The fish will soon get caught that nibbles on every bait.

• • •

A common misuse of psychology, although often a legitimate use, consists in openly declaring an act creditable or discreditable:

"It's smart to . . ."

"Don't be a piker."

"A home owner is a good citizen."

"Don't be the kind of person who is easily swayed"

"Women of prominence now use ———."

• • •

A more subtle way of making small things seem great, or great things small, consists in speaking of them with words that serve as traps. Here are pairs of words used to describe the identically same action favorably or unfavorably:

concession	appeasement
enthusiasm	fanatacism
bravery	foolhardiness
frankness	tactlessness
cooperation	collusion
helpfulness	officiousness

• • •

The victors in a battle that was fought through a wooded and stony area were referred to by one commentator as having cleverly taken advantage of cover, and by another as having sneaked and skulked behind rocks and trees.

Frequently deception appears in the use of highly abstract terms—enduring clichés. A term from the top rung of the ladder of abstraction misused in many parts of the world is *freedom.*

Because of the fact that speaking of an idea with a certain word can give it fragrance or stench, the cunning person usually puts his trust, not in the right argument, but in the "right" word.

Words extensively misapplied in order to make white seem black, or black white, ultimately become debased currency.

Forms of rhetoric also are subject to abuse. This is especially so if the audience is in a pleasure-seeking mood rather than in an inquiring state of mind. Such persons offer comparatively little resistance to thoughts neatly and adroitly dressed. To many of them, a fascinating tale in beautiful rhetoric is truthful.

Ridicule is another method that can be used effectively in misguiding other persons. Almost anything can be distorted to appear ludicrous, and most people tend to avoid doing what would make them a laughing-stock Unscrupulous persons therefore often use ridicule to assail views or practices that are, in reality sound. The most common abuse ridicule is that of giving an exag ated account of a view expres of an act performed. When r

is embodied in a figure of speech it is most effective, because figures are vivid and tend to make the derision seem well founded. Capital and labor both have used the figure "cart before the horse" to deride attempts to bring about general prosperity by legislating to the immediate advantage of the other group.

A common form of trickery consists in conferring upon someone an apparent favor as an expression of appreciation, when the real motive is to obligate him Most people, to avoid being rude, accept an apparent favor, and then to free themselves of embarrassment they requite the obligation. Unprincipled individuals in every kind of human relationship, by exploiting these human virtues of courtesy and fairness, get other persons to accept unordered merchandise, and make them pay dearly for it.

Such artifice is so thin a cobweb that it may be seen through, yet it catches flies of considerable magnitude. A candidate for political office may unwittingly accept support from persons who expect favoritism in the event of his election to the office. The great problem of political science is that of finding ways of having leaders that are not only able but also free of the feeling of high indebtedness to individuals or groups rather than to the people as a whole.

Another common abuse of psychology, mildly mischievous or grossly misleading, is to enshroud things in mystery. Although the unmasking of all mystery would rob people of much pleasure, it would also take from many disseminators of falsehood one of their most effective devices. This suggests again that the fish taken are not all caught with the same kind of bait. Every principle of psychology can be put to wrong purposes.

Wing-Flap Scheme for Vertical Takeoff

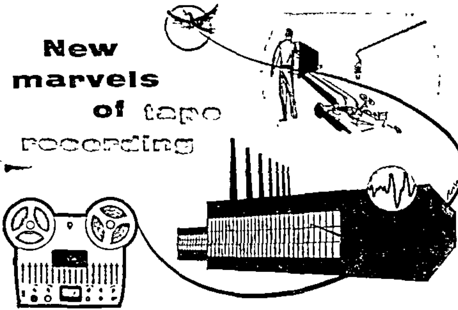
A new type of experimental wing flap that would allow vertical takeoff for conventional-looking planes was tested at Langley Air Force Base in Virginia by the National Advisory Committee for Aeronautics.

In the new scheme, fast moving, triple-bladed propellers with a somewhat larger than usual diameter are mounted on the wings in conventional position. They thrust back high-velocity winds that are deflected downward by movable wing flaps to achieve the lift.

Once the plane is in the air the flaps could be set in horizontal position for normal flight.

The tests showed that the propeller backwash would be deflected 67 degrees downward with the system. The scientists pointed out that it is not necessary to bend the wings a full 90 degrees. The nose of the plane could be tilted upward at takeoff.

New marvels of tape recording



by George Melloan

Condensed from The Wall Street Journal

TAPE RECORDING, a seven-year old child prodigy, is still finding new outlets for its versatile talents.

Tape recording is, of course, a relatively easy, economical way of capturing, storing and reproducing sound. The tape involved is a narrow plastic strip coated with an iron oxide emulsion In operation, it unwinds from a reel and slides across a tiny electromagnet. As you talk or play music into a microphone, the sound waves are changed to electrical impulses which move through the magnet and set up a magnetic pattern on the tape. When the tape is played back on the same equipment, the pattern is converted back to sound.

So far tape recording has blossomed largely as a preserver of amateur home entertainment — from Junior's Sunday-school recitation to Uncle Charlie's imitation of Jackie Gleason. But it's being groomed for professional amusement roles, both as a possible rival to the phonograph and as a potential replacement for film in recording television sound and pictures. It may well become the electronic master of automatic industrial processes.

Using a tape recorder attached to a stethoscope, Dr. George David Geckeler at Hahnemann Medical College in Philadelphia records the variety of sounds made by different heart disorders for teaching heart-disease diagnosis to doctors. →

The Wall Street Journal (Feb 18, '55), 44 Broad St, New York, N Y

cording patents which it licenses to 64 foreign and domestic firms.

After World War II, a magnetic recorder using plastic tape was demonstrated to singer Bing Crosby, who quickly decided that tape's excellent tone quality and suitability to editing made it ideal for recording radio shows. Meanwhile, record companies began to "tape" music, so it could be edited and then transferred to a master disc. Today radio and television stations, record companies and the movies are all extensive users of tape. Since the tape recorder came into retail stores in 1948, it has all but crowded out its older brother, wire recording.

Wider use of magnetic recorders as the memory device to control automatic operations in industry is predicted by W. L. Dunn, president of Magnecord, Inc. To demonstrate at a recent automation show how magnetic tape control of a process would work, Magnecord built an automatic pancake-batter mixer, in which a series of sounds of varying frequencies played on tape cause flour, milk and other ingredients to be dumped into a mixing bowl.

Tape-recorded background music for factories and stores is another growing field.

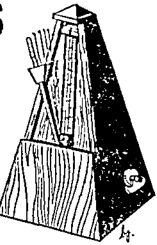
Machines that record both the picture and sound captured by a television camera have been developed by both RCA and Bing Crosby Enterprises, Los Angeles. Basically, the recording machine simply stores on tape the electrical signals which the television camera generates. Although it involves some new problems, the recording process is much the same as that for recording sound impulses.

Although neither company has offered the machines commercially, David Sarnoff, chairman of RCA, describes the development as the "first major step into an era of electronic photography in which motion pictures in color and black and white will be produced quickly and economically without the need for photographic development and processing." RCA has said it hopes to have its machine in commercial use by the end of 1955.

Doctor E. W Engstron, executive vice-president in charge of RCA's laboratories division, says the primary reason for development of the video tape recording process is to promote the advancement of color television by eliminating the time lag and expense of processing color film for TV use.

In the movies, multiple magnetic sound tracks permit the stereophonic sound of CinemaScope and Cinerama, where different sounds are emitted from various speakers around the theater. In searches for oil, tape-recording equipment costing up to $50,000 per crew is used to record the vibrations from explosions prospectors set off to gain knowledge of underground formations. Tape recorders in the $17,000 to $18,000 bracket are used to pick up electronic "information" sent back by guided missiles. In business machines, it's predicted, tape may some day replace punched cards as a means of storing information.

STRANGE RHYTHMS IN LIFE



by Irving Adler

Condensed from a chapter of the book, Time in Your Life

The Living Clock

The fiddler crab, with its characteristic oversized left pincer, is a living clock. It shows the time of the day by the color of its skin, which is dark by day and pale by night. The daytime darkening of its skin, which helps to protect the crab from the sunlight and from its enemies, follows a regular 24-hour rhythm The color rhythm of the crab matches exactly the daily rhythm of the sun, the rhythm of day and night.

But is the crab really keeping time? Isn't it only responding to sunlight, growing darker when the light strikes it, and becoming pale again when daylight fades?

To answer this question, biologists who were studying the crab kept him in a dark room for two months. They found that even when no daylight strikes him his skin still changes color with a regular rhythm, keeping pace with the rhythm of day and night outside. This proved that he wasn't merely following the rhythm of the sun, but had a built-in rhythm of his own.

The color rhythm of the crab must have developed, through millions of years of evolution, in response to the rhythm of the sun But by now it needs no outside regulator. It is regulated inside the living body of the crab

While the skin of the fiddler crab is dark all through the daytime, there is one part of the day when it is extra-dark. Biologists recorded the time when the skin is darkest. They found that each day this happens 50 minutes later than the day before. This 50-minute lag is the clue to another rhythm that the is following, the rhythm of the In fact, the moment of greatest ening turns out to be

a mouse beats about 300 times a minute. The heart of a man beats from 68 to 72 times a minute. An

elephant's heartbeat is 35 to 40 times a minute.

In 1952 a man from Boston went on a whale hunt, but he was not a sailor, and he was not interested in whale oil. He was a heart specialist, and he wanted to measure the heart beat of a whale. His expedition harpooned a whale in Bristol Bay, off the coast of Alaska. The harpoon he used was one of special design, connected by a cable to an electrocardiograph that made a record of the whale's heartbeat. The whale's heartbeat was 20 times a minute.

South American "Pygmies"

Several generations of miserable living conditions can make a people into dwarfs, Rev. Dr. Martin Gusinde, anthropologist of Catholic University, Washington, told the American Association of Physical Anthropologists

That is what Dr Gusinde found when he went to explore rumors of a race of pygmies living high in the mountains between Venezuela and Colombia. The rumors of South American pygmies have persisted since the first conquerors explored the region in 1520.

The people are small, Dr. Gusinde found, but they are not true racial pygmies. These Indians, named "Yupa," live in very small communities called "rancherias," consisting of from 2 to 15 individuals. It sometimes happens that the average height of the adult men of a rancheria is 4 feet 11 inches or less

But even if it should be found that all the Yupas are as small as that, they could not be considered as true pygmies. Their small size is a result of the deprivation in their living conditions.

Disease Detectives

Before long, scientists will be able to predict crop-disease damage better than ever before. Two Kansas State College scientists have come up with an improved "spore catcher" that tells them how many and what kind of plant diseases are floating northward on spring breezes from Mexico and Texas. The machine, which plugs into an automobile cigarette lighter, was invented by Dr. S A. Pady and D. A. Rittis.

—*Farm Journal*

30,400 Miles an Hour

by Raymond Thompson

Condensed from The Baltimore Sunday Sun Magazine

A 12-foot-long tube in a University of Maryland laboratory may provide the answer to the problem of hurdling the thermal barrier—man's next obstacle in the conquest of space.

Within the steel tube, research scientists have been able to produce shock waves traveling as fast as 30,400 miles an hour. This is 40 times the speed of sound, far more than the attained flight record of 1,650 miles an hour, and more than is needed for interplanetary travel.

Scientists figure that about 25,000 miles an hour would let a spaceship or guided missile escape from the earth.

At present, however, such air speeds are limited by the thermal barrier, the term coined to indicate the velocity at which projectiles begin to melt. At speeds more than Mach 5 (five times the speed of sound) all commonly used engineering metals become molten. Strange things happen to the air.

What happens to the air—and why—are the questions being studied by the university's Institute for Fluid Dynamics and Applied Mathematics, jointly with the Air Force's Research and Development Command. Though the study is essentially one in pure physics, Dr. Edwin L. Resler, who heads it, believes it will produce basic information of importance to missile and aircraft designers.

Doctor Resler explains that in high-speed flight a body moving through the atmosphere is always preceded by a shock wave. The air ahead of the wave is cold, and the violent heating which constitutes the thermal barrier occurs across the shock wave itself.

In experiments begun while he was at Cornell University, Dr. Resler has been able to simulate in the steel tube the effects which would occur in flight at Mach numbers up to 40

To study these effects, he and Dr. B B Cary, an associate, must collect data in a few millionths of a second

The square tube in which the tests are run was built in the institute's shop; it cost about $500. It has a 1-inch inside diameter, with 1 inch walls of steel, necessary to stand the high pressures. Two of the tube are filled with

The Baltimore Sun (Mar 27, '55), Baltimore 3, Md.

and oxygen, held back by an aluminum diaphragm.

The violent shock waves are produced by igniting the hydrogen-oxygen mixture, which explodes, bursting the diaphragm and compressing the air ahead of it in much the same way that a body flying through the atmosphere would compress the air ahead of it. The result in both cases is the shock wave, and the pressures needed to generate it are as high as 10,000 pounds to the square inch.

The biggest problem facing the scientists is that the temperatures caused by these shock waves are two or three times greater than the temperatures at the surface of the sun — 9,760 degrees Fahrenheit — hot enough to boil away pieces of metal from the tube walls.

The scientists must replace some sections of the tube every six months.

At these high temperatures inside the tube, some electrons are stripped from the molecules in the air. The free electrons, conducting electricity, set off a spark as they pass the first of three spark plugs mounted atop the tube. [illegible] wave takes its own picture.

The free electrons also pass two other spark plugs, setting off an electronic device which measures the wave's velocity.

The whole cycle of events—from the time the hydrogen-oxygen explosion occurs until the shock waves bounce off the other end of the tube—takes only about 1/1,000th of a second.

Only a fraction of this cycle interests the researchers. In fact, Dr. Resler allows the shock wave to travel 8 feet before he takes a look at it — by means of an air-turbine-driven drum camera revolving at speeds as high as 10,000 revolutions per minute, which takes a continuous picture of the shock waves.

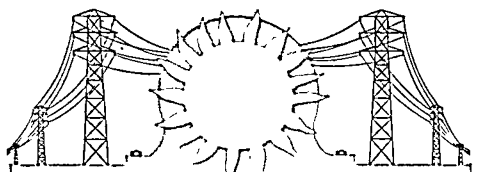
The spark initiated by the shock wave passing the first spark plug permits enough illumination for pictures of the waves to be taken as they pass a pinpoint of a window at the other end of the tube. Light created by the spark is reflected off a series of mirrors known as an interferometer to provide just enough illumination for the pictures to be taken.

• • •

As a result of these, and similar experiments in laboratories throughout the country, scientists now know that air changes its properties in going through the shock waves — the molecules break and electrons are thrown off.

What Dr. Resler and his associates are trying to find out is the makeup of the air which will surround the aircraft or missiles after having been subjected to the shock wave.

They believe their experiments will help solve the problems associated with the thermal barrier. They are just as convinced that, once these problems are solved, the thermal barrier will be no more of a problem than the once formidable sound barrier, and interplanetary travel may be made possible.



SOLAR POWER IS COMING!

Condensed from Research for Industry

THE SUN showers the earth with thousands of times more energy than man uses The roof of an average house in the United States intercepts about 500 times more energy than the electricity used by a typical American home.

This energy is free for the taking; but the taking is extremely difficult.

Although ancient man used the heat of the sun to dry ponds of sea water to obtain salt, to open temple doors, and to make statues move, little real progress in application has been made since. This, despite today's advanced technology.

The sunlight we see — and the ultraviolet and infrared part we cannot see—are electromagnetic radiation, just as are radio and television waves. The rainbow gives a clue to the nature of sunlight—that it consists of many colors ranging from a small portion of ultraviolet (as sunburn victims know) to visible blue, red, and then into the infrared we feel as heat but cannot see.

So much for appearance. More minutely, sunlight consists of bundles of energy that make the 93-million-mile trip and penetrate the earth's atmosphere, striking the molecules making up the rocks, earth, water, or plants of the earth's surface Using solar energy involves putting to work the various ways individual molecules can react when struck by solar "bullets"—the energy-bundles technically known as photons.

The simplest change that can occur to a molecule struck by a photon is *nothing*. This is what a mirror does. Much of the sun's rays is immediately reflected by the earth's surface to the sky to be lost forever

Mirrors are not themselves solar-energy devices but can be used with mechanisms that make use of t' tremely important second effect—the conversion of the of solar radiation to heat. A

Research for Industry (Mar '55) · A News Bulletin from Stanford Research Institute, Stanford, Calif

:an be set in motion by the "bullets." The molecule holds the energy briefly and then gives it up. But—and this is the key to the phenomenon—the energy is given off in smaller bundles of infrared photons, or *heat.*

These two actions are the basis of the simplest solar-energy device—the mirror-type heat collector. By using reflecting surfaces (or lenses), photons are concentrated onto a small area. This is the secret of both the solar stove and the solar furnace.

A simple solar stove is being manufactured for sale in fuel-poor, sunrich India. Several large solar furnaces are in operation. Temperatures above 7,000 degrees Fahrenheit have been attained Consolidated-Vultee Aircraft Co in Los Angeles operates a furnace with a 10-foot mirror. Prof Felix Trombe of France produces high-temperature ceramic materials with a mirror furnace. In Algeria a furnace with a 27-foot mirror was built to produce fertilizer by fixation of nitrogen in the atmosphere.

Heat generated from solar radiation either by concentration or direct exposure of devices can be used by certain instruments to produce small amounts of electric current.

The greenhouse is an example of another device employing this same principle of converting light energy to heat. This is the flat-plate collector. Light enters through the glass and is converted to heat by the objects inside. This heat is trapped because glass is opaque to the infrared or heat radiation.

The flat-plate-collector idea can be used for house-heating. The Dover House in Massachusetts is one of these. Or, gas or water can be pumped through the collector to be heated and then used to drive some form of heat engine to perform useful work. An Italian firm sells several sizes of solar pumps that obtain their heat from flat-plate collectors.

Problems of flat-plate collectors are mostly those of cost. The more layers of glass and the better the insulation the greater the heat recovery—and the higher the cost. Also all known engines for converting low-temperature heat to power are woefully inefficient. The absolute maximum efficiency for a perfect heat engine using heat 250 degrees above the temperature of its cooling source of, say, 65 degrees, is 32 percent. Losses in practical machines reduce this to less than half.

A third type of molecular response to light energy is called *phosphorescence.* When molecules of certain substances are struck by photons of sufficient energy some of the electrons are pushed away from their usual orbits. When these fall back into place they emit photons of energy. The color of this emitted light energy differs from the incoming light. Phosphorescence represents an interesting way of storing energy briefly, but is not regarded as having prospect as a major energy device.

Still another way of using the sun's energy is to lift electrons entirely away from their molecules. These negative charges create electric current. The photographer's exposure meter operates on this principle.

The *silicon solar battery demonstrated* by Bell Telephone Laboratories is a photoelectric power source. It has an efficiency of about 8 percent, which further development may double. Efficiency limitations are due, in part, to the fact that most solar photons (in the infrared) are too weak to release electrons from the silicon atom and are wasted. Further research may provide materials other than silicon that are less costly and more efficient solar-electric converters.

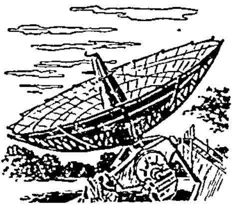
Solar energy can also cause actual molecular changes. In fact, these reactions make animal life possible. *Sun-energy reactions provide* the world's oxygen and food

The best-known reactions of this type are conducted by nature through chlorophyll — a substance present in all living plants In some way *still not explained, chlorophyll* converts water and carbon dioxide into carbohydrates and oxygen.

Although photosynthesis, as it is called, is essential to life, it is usually not an efficient converter of sunlight into chemical energy. Estimates of this efficiency in the laboratory run up to 65 percent, but most experts believe it to be about 25 percent. In fields and forests the conversion is considerably less. Most farm crops use about ½ of 1 percent of the light that falls on the land.

Photosynthesis is also accomplished by Chlorella, a green single-cell plant. This algae offers prospects of producing both fuel and food.

Chlorella has the advantage that it can be grown continuously in



Forty-ton solar oven in Algiers, North Africa, designed by Prof. A Guillemonot, synthesizes nitric acid from air, water, chalk and sunshine. Its 27½-foot parabolic reflector creates temperatures up to 300 degrees C

water. Also proportions of carbohydrate, protein, and fat in the end product can be varied widely, depending on whether food or fuel is desired. Although many problems *are unsolved* there remains the possibility that 20 tons of protein and 3 tons of fat can be produced annually per acre in this way, far beyond the productivity of land plants.

The possibility of using sunlight to break up water molecules into hydrogen and oxygen also holds great fascination. These two gases could be stored for recombination to release the energy as needed.

It would be highly desirable to recover the stored chemical energy directly as electricity without going through the wasteful heat cycle or using moving machinery. Small, experimental cells are already do' g this, with efficiencies in excess of percent being reported.

Several reactions by which .

can be dissociated by light into hydrogen and oxygen are known. The problem is to develop practical systems. At Stanford Research Institute scientists are studying the reaction by which a solution containing some inorganic compound and a

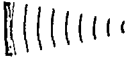
energy utilization is gaining momentum and it is growing more and more clear why man from the beginning of time has paid homage to the sun.

Cross Pheasant With Turkey

Success in crossing pheasants and turkeys, apparently achieved only once before and that 200 years ago, is announced by V. S. Asmundson and F. W. Lorenz of the University of California Poultry Department at Davis, Calif.

Weight of the mature hybrids of this cross is between the turkey and the pheasant. The head furnishings are like those of the pheasant. The plumage color, from the cross between ring-neck pheasant and Bronze turkey, is dark brown shading to black except on the wings which are lighter. The hybrids apparently are sterile

—*Science Service*



Create "Beams of Silence" in Deafening Noise

Engineers have taken a roaring electric power transformer and quieted it down by adding more noise.

This feat was made possible by the phenomenon of wave cancellation Two identical sound waves can completely wipe each other out when they are out of phase, that is when the crest of one corresponds to the valley of the other. Thus, under certain conditions two noises, no matter how loud they are, can be combined to produce complete silence, at least theoretically.

The experiment with the noisy transformer has not gone that far, W. B. Conover and R. J. Ringlee of the General Electric Co , Pittsfield, Mass , explained, but they have produced what they call a "beam of silence"

The beam *eliminates much of the* noise from the transformer in a 30-degree angle They called the effect "astonishing' and said that once the electronic adjustment had been made they could turn the transformer noise off or on at will merely by switching on or off the competing noise

The equipment, they said, was much cheaper than conventional sound barriers and it promises to be "by far the most economical and satisfactory solution for noise problems where a limited area only is involved."

The direction of the "beam of silence" could be changed by adjusting the syncopated phase of the loudspeaker noise. It was pointed out, however, that although noise is reduced in one direction there is more noise in other parts of the room.

GLITTERING YARNS

Condensed from Industrial and Engineering Chemistry

WHEN YUL BRYNNER strode the boards of New York's St. James Theater in the lead role of *The King and I*, his slippers were a clever bit of stage deception.

To viewers in the first few rows, the fabric of his brilliantly ornate footwear looked like 24-carat gold Actually, it was nothing of the sort. The metal component was aluminum, not gold, and the material was mostly plastic, not metal. Here was just another example of chemical ingenuity applied to the development of an intriguing new product for the textile industry. The product: metallic yarn.

Today, metallic yarn is one of the hottest fashion items in the textile field. You'll find it as the sparkling metal thread running through decorative modern drapes, upholstery, table linens, bathing suits—even in shoelaces.

One of its biggest new applications is in automobile upholstery (Ford, Studebaker, Buick, Cadillac are using it) and in saran seat covers.

Let's be perfectly realistic about this. Metallic yarns are nothing more than dyed, plastic-covered filaments of aluminum.

Although each manufacturer has his own special techniques for turning out these yarns, the process, in general, starts out with a roll of aluminum foil, 0 00045 inch thick and about 20 inches wide. To both sides of the sheet is applied a solution of thermoplastic adhesive, to which have already been added the required coloring agents. After the adhesive-coated foil is treated by heat at about 200 degrees Fahrenheit, a sheet of transparent film is laminated to each side of the foil at a pressure of about 2,000 pounds per square inch, applied by squeeze rolls.

The film-foil-film sandwich is then slit into filaments of the desired width and wound around spools for storing and handling. The most popular width is 1/64th inch, although the material is also available in sizes ranging from 1/8th to 1/120th of an inch. Recently, Reynolds Metals introduced a staple yarn of unl nated aluminum as fine as 1/20th an inch

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Industrial and Engineering Chemistry (Mar '55), published by the American Chemical Society, 1155 Sixteenth St N W, Washington 6, D C

A critical factor — and a closely guarded secret—in the manufacture of metallic yarn is the adhesive. Also important are the coloring agents, either dyes or transparent pigments. The most popular colors are gold (which accounts for over half the demand) and silver. Gold is produced by the addition of a yellow-orange dye to the adhesive, while silver is merely the color of metallic aluminum.

Other colors available include bronze, gunmetal, chartreuse, emerald green, peacock blue, and dragon red. To all of these, a brilliant luster is imparted by the underlayer of aluminum. For a more subtle sheen, use is made of opaque porcelain colors.

Leading U. S producers of metallic yarn are Dobeckmun Co , Metlon Corp., Reynolds Metals Co., and Standard Yarn Mills Together, their output (which goes under the respective trade names of Lurex, Metlon, Reynolds aluminum yarn, and Lamé) totaled about 2 million pounds in 1954, with a value of between $8 million and $10 million.

Far and away the biggest appeal of metallic yarn is its decorative value. Any special heat-insulating properties (such as those of the Milium treatment for fabrics, involving a thin coating of aluminum flake), are purely incidental. Since metallic yarn has the ability to reflect radar waves, it has been used successfully in tow targets.

Admittedly, metallic yarns of a sort are very old hat. They go back at least as far as the ancient Persians and Chinese. Centuries ago, luxurious tapestries and brocade were made of fine strands of 24-carat gold wrapped around copper wire, or strands of gold-plated copper. But among the major drawbacks of gold fiber are its cost (today as much as $60 a pound) and gradual tarnish.

With the new yarns, the price is as low as $2.80 a pound. Since the metal is aluminum, there is no tarnishing. Because of the plastic film, the yarn is flexible and moderately stretchable. At the same time, it is light-weight, with an attractively soft texture. As a special bonus, acetate-laminated metallic yarn can be washed at temperatures as high as 160° F., can be dry-cleaned, and can be conveniently ironed.

Recently a host of new applications for metallic yarn have emerged. It's being made into an excelsior-like packaging material for such luxury items as perfume. It's being chopped up fine for use as ornamentation on greeting cards and window displays. As a just-announced use for this metallic confetti (Metlon calls it Wink), it's being added to vinylite floor coverings to produce bright flecks of decorative sparkle.

U. S. Rubber wraps metallic yarn around rubber thread to produce an elastic yarn that glamorizes such items as women's sandals — which, incidentally, were one of the fastest-selling gift items in department stores last Christmas. There seems to be no end to where you'll find metallic yarn — whether it's in a luxurious evening gown, a richly ornate ecclesiastical vestment, or perhaps in your boy's flashy suspenders.

Super-Efficient Vacuum Pump

by Harry S. Pease

Condensed from The Milwaukee Journal

RAYMOND G. HERB, a University of Wisconsin physicist, wanted a better *nothing*.

He got one. As a result, the Wisconsin Alumni Research Foundation will probably have tens, or even hundreds, of thousands of dollars for new scientific projects.

And all of us may have better or cheaper radios and television sets, may benefit from new discoveries in medicine made possible by improved electron microscopes and X-ray equipment, and may gain in scores of other ways through improved industrial technology.

Herb invented a vacuum pump that works on a principle never before used for such equipment.

The best conventional pump of comparable size will remove all but one out of every billion molecules of gas from a closed container. Herb's will go that far, and then get 99 out of every 100 that are left.

The new device works two to ten times as fast as conventional ones.

Ordinary pumps let traces of vapor escape into the chamber they are evacuating. Herb's does not do so.

Moreover, it is small, compact and simple Its only moving parts are in a little device that moves a wire about one-half inch a minute.

Herb needed the pump for a new atom smasher he is building. As far as he was concerned, it was strictly a laboratory tool. But he and university officials saw that it had tremendous industrial possibilities particularly in the field of electronics.

He patented the pump, which he has been calling the "Evapor-ion." Then he assigned the patent to the Wisconsin Alumni Research Foundation. The foundation, in turn, licensed the Consolidated Vacuum Corp., Rochester, N. Y., to build the devices commercially on a royalty basis.

The Herb device—"I've called it a pump but it really should be called something like a trap," he said recently — depends on the affinity of most gases for a "new" metal, titanium.

Stronger than aluminum, " than steel, titanium is finding creasing use in aircraft

The Milwaukee Journal Milwaukee 1, Wis

and other commercial products these days. For years, though, it had no industrial importance because it was so hard to refine. One of the difficulties in working it was the one on which Herb capitalized.

Titanium combines very readily with many other materials, including gases. The exact process of combination is not understood fully — it may be chemical and it may be simply a matter of the molecules sticking together. Anyhow, it happens.

The chamber of the Evapor-ion pump is a cylinder some 30 inches long and 8 inches in diameter. In it, the air molecules move around like balloons in a ballroom.

At one end of the chamber is a plate about one-half inch in diameter, heated electronically to almost 4000 degrees Fahrenheit.

Titanium wire two hundredths of an inch in diameter — about the thickness of a common pin — feeds toward the plate In that heat, the titanium vaporizes.

Each droplet of titanium grabs a few molecules of gas and hangs on. Drifting around the chamber, the titanium soon comes into contact with the cool wall and condenses like frost on a mint julep glass. The cylinder wall acquires a velvety gray plating of titanium, and the gas is sealed up in the metal.

That works fine for the common components of air—nitrogen, oxygen and water. But air also contains traces of gases like neon, the so-called "noble gases" which do not react with much of anything. Scant though they are, they would be intolerable contaminants in Herb's experiments. He licked them, too.

He built into the device a tungsten filament that emits a shower of electrons. Around the wall of the cylinder he arranged a spiderweb of fine wire which can be electrically charged.

The showering electrons bounce around in the chamber at high speed They knock other electrons loose from the atoms of noble gases, leaving them with an electric charge Then the charged atoms are driven into the wall by an electric field They penetrate so deeply they cannot escape before titanium covers them up.

The unit uses astonishingly small amounts of titanium to do its job A pound of wire would be ample for years of operation, Herb says.

There seems to be little doubt about the workability of the devices. He has built six for his own purposes

Herb, 47, is a Wisconsin farm boy who became a world authority on a kind of atom smasher called the Van de Graaff generator, which uses huge charges of static electricity — artificial lightning bolts — to hurl its atomic bullets.

Though Herb did not invent the Van de Graaff, many physicists credit him with making it work. Herb himself will admit only that he improved its performance.

When World War II came, the Army's Manhattan District — later the Atomic Energy Commission — carted Herb's two Van de Graaffs off to Los Alamos, N. Mex., where the atomic bomb was built.

Herb knew about the project but he was not very optimistic about the bomb's working. He went to Massachusetts Institute of Technology to do research on radar.

After the war he had a time getting his machines back. Finally he got one, and Wisconsin got $80,000 for the other.

Now he is pushing the machines toward higher energies. He is concentrating on the tube down which the "atomic bullets" hurtle. It is six feet long and four inches in diameter and must be empty, even of air.

"One major difficulty limiting the voltage is the tube," he said. "We still do not fully understand what happens, but it is highly probable that vapors from rubber gaskets cements and so on condense on surfaces and play a role in our troubles."

What he wanted was a highly efficient vacuum pump which would clear out the air and keep on working, so the tube could be heated and the vapors driven off and pulled out.

He began experimenting in 1949 on ideas to get rid of the gas. He tried activated charcoal like that used in gas masks. He tried chilling the equipment with liquid air. He tried pumping in hydrogen to drive everything else out and then letting the hydrogen leak through a rare-metal barrier.

None did what he sought to do. Then he started in with titanium. "It was immediately very successful," Herb said.

Million Viruses Needed for Single Infection

It takes as many as a million viruses to establish a single infection, research with tobacco mosaic viruses at the University of California at Los Angeles indicates The investigators were Drs Albert Siegel, Irving Rappaport and Samuel Wildman.

Such a large number of viruses is required apparently because only a few of the virus particles have the power to reproduce themselves. The remaining particles seem to be inactive and play no role in reproduction Chances are also small that an infective particle will find a susceptible site for attachment.

Apparently a single cell cannot be infected simultaneously with two active viruses. The infection seems to spread from cell to cell through protoplasmic strands which connect them The reproducing units which cross over the protoplasmic bridges are probably different from the fully formed, mature viruses. If fully formed viruses are extracted from the tobacco leaf they are incapable of starting another infection.

The process of virus reproduction ends with the death of the cell, approximately 20 hours after the virus attaches to its protoplasm. By this t' 500,000 virus rods are m by the cell as a result of a code by the infectious virus.

—Science

Device Lets Pilot "Jump" at Ground Level

British engineers have successfully tested a new lightweight aircraft ejection seat that can parachute a pilot to safety from a speeding aircraft, even at ground level.

It is expected to mean far greater safety for combat pilots in aircraft that develop trouble during takeoff or low-level bombing or strafing missions. Normally pilots have no opportunity to escape from planes and parachute to safety from low altitudes.

The seat was developed by the Baker-Martin Co. of Denham, Buckinghamshire, which pioneered the ejection principle in 1945. Details released recently said the device weighed about 60 pounds, or two-thirds the weight of a standard ejection seat.

During tests in Oxfordshire it was said, the device, fitted with a life-size dummy, was placed in the rear of a jet fighter. At a speed of about 130 miles an hour, and before the pilot had lifted the plane off the runway, the seat was fired.

There was a puff of smoke from the ejection cartridge, the seat and dummy shot 80 feet into the air and a standard 24-foot parachute snapped open. At this moment the seat fell away and the dummy drifted safely to earth.

Observers said that heretofore ejection at points below 500 feet had been considered unsafe because of the failure of parachutes to fill with air.

The device is being fitted into the Gloster Javelin and the Hawker Hunter, Britain's latest jet fighters.

—*The New York Times*

Ocean No "Melting Pot" for Fish

Fishes keep to their own sides of the sea.

The Smithsonian Institution has received a collection of more than 1,000 specimens of Liberian fishes, mostly from salt and brackish African water, obtained over a 2-year period by George C. Miller, of the Fish and Wildlife Service of the Department of the Interior. This contains many species and varieties hitherto not represented in the national collections, but its particular interest, says Dr. Leonard P. Schultz, Smithsonian curator of fishes, is in the differences it shows between the sea creatures of the eastern and western Atlantic.

Superficially they may be quite similar. When studied, however, they are found to represent quite different types. Thus, an ocean turns out to be far from a "melting pot." "There are no stepping-stone islands across the tropical Atlantic," Dr. Schultz says.

This segregation is more clearly defined for coastal and estuary fishes. But, it appears from this collection, even those species which spend most of their lives in the open sea seldom get across to mix with fellows on the other side.

Taking the Oceans' Temperature

by Lou Bahm

A NAVY MAN with a yen for temperature-taking is sailing the seven seas armed with his bathythermograph — that's right, a thermometer for the bath.

Eugene C. LaFond is an eager man with odd tastes in how to spend his leisure time. As head oceanographer at the U. S. Navy Electronics Laboratory, he has sailed the Atlantic and the Pacific, spent a year in India, and gathered data from around the world making fever charts of oceans. All that, mind you, along with his other duties in Uncle Sam's Navy.

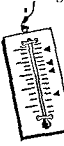
LaFond is penciling hundreds of wavy lines, which he calls tempera- [illegible]

get should he care to travel straight down at that point. If you are contemplating such a trip, you will find 77 of LaFond's charts printed in *The Scientific Monthly*.

As you suspect, the water is usually warmer near the surface, due to the sun's rays. But you won't always find it so, says LaFond. And it doesn't just gradually get colder the deeper down you venture. For one thing, the wind churns it around. A wind of 15 miles per hour, for example, will stir up water to a depth of about 25 feet.

Too, you'll find waves deep within the oceans, he says, due to differences in water density. There are not only the scenic white caps you see when cruising over the surface, but completely invisible waves undulate below—sometimes only seconds apart, sometimes many hours. A sea of troubles for the temperature-taker!

The most pronounced daily heating of the deep occurs in our temperate zones during the summer. Here at midnight the water is often the same temperature for 50 feet down and becomes still colder at th surface by six in the morni providing a proper ch for those gymnastic f who swim before their



fasts. By nine o'clock the summer sun has restored the surface water to the same temperature as that below.

You may wonder if anybody cares about ocean temperatures besides Mr. LaFond and the fish. The men known as sonic depth finders, whose business it is to keep us informed on the underwater world, will find his temperature charts fascinating, if not downright necessary.

These men send out ultrasonic waves, which are the same as sound waves except that they are pitched too high for our ears to hear. Then they wait for echoes to bounce back off some explosive mine, etc.

They want to know how long it takes the echo to get back and also from what direction it comes. But the warm and cold streaks in the water upset their reckonings. Sound is slower in cold water than in warm and, what grieves them more, it changes direction when the water changes temperature. All this m[illegible] the underwater treasures and terrors seem to be where they aren't. That is why the sounding fellows carry bathythermographs.

Personality Differences Determine Success, Failure

Why are some brilliant and talented individuals successful while other gifted persons fail to live up to their promise?

A University of California psychologist has part of the answer. Dr Harrison G. Gough, associate professor of psychology, says that the key personality differences are in the individual's "psychological persistence" — persistence growing out of self-acceptance, trust in others, and a conviction that work and effort are worthwhile.

"Gifted persons who utilize their abilities possess these factors in abundance," he said. "Those who fail to make use of their talents do not."

These conclusions result from a part of a three-year project on the measurement of favorable traits of personality and character. The project has employed a special test, the "California Psychological Inventory," which was created by Dr. Gough.

More than 10 000 individuals participated in the tests. Results from intellectually superior students who performed poorly in school were compared with those from brilliant students with good scholastic records. Gifted high school students who did not attend college were compared on the basis of test scores with gifted students who did.

For example, Dr. Gough found marked personality differences between talented high school students who go on to college and those who do not. These differences would seem to call for a new approach to "selling" gifted students on college attendance. The California psychologist's study showed that the gifted high school student who goes on to college tends to be industrious, conscientious, patient, honest, and warm. On the other hand, the gifted high school student who does not attend college is apt to be described by his associates as autocratic, blustery, conceited, self-seeking, and stubborn.

a science milestone

WALTER REED

— AND THE CONQUEST OF YELLOW FEVER

by Ruth Fox

Condensed from a chapter of the book, Milestones of Medicine

THE YEAR was 1900. The United States Army Yellow Fever Commission, newly convened on the porch of the officers' mess, at Havana, Cuba, was composed of four men. Walter Reed, James Carroll, a one-time Canadian backwoodsman who had joined the army as a private, and had taken up medicine 12 years later; Aristide Agramonte, a Cuban-born pathologist from Columbia University; and Jesse Lazear, an American physician.

It had become a matter of professional necessity for every doctor to range himself on one side of the yellow-fever controversy or the other. The question could not have been more straightforward: Is yellow fever contagious, or is it not?

The men who believed it was contagious held that the disease was spread from person to person by direct contact. The "non-contagious" school avowed fiercely that it generated itself "spontaneously," under proper conditions of heat and filth, and that it could not be spread by direct contact.

About the time of the 1878 epidemic, doctors began to believe that yellow fever occupied a peculiar place between contagious and non-contagious diseases. It was not spread by direct contact like smallpox, they said, for the "emanations" from the sick required a warm, dark place in which to grow strong enough to infect the next comer The sick man himself was harmless. But his bedding, his clothing, his furniture, any of his material possessions, in fact—these were the villains. The term *fomites*—a Latin word meaning substances capable of transmitting contagion—came into use.

• • •

"There's an old man on this island," Lazear said, "who would tell you that yellow fever flies in the window on the wings of a female mosquito."

"Old Finlay?" Reed asked. "He's been saying it for quite a while, hasn't he?"

"In Cuba," Agramonte said, "it's hard to remember a time when old Finlay *wasn't* saying it."

The mosquito. . . . Through all the controversy between the advocates of the *fomites* theory and direct-contagion proponents, an old doctor with mutton-chop whiskers and the [illegible] tradictory name of Carlos F[illegible] was holding out for the [illegible] He had been living in H[illegible]

36 years before the Yellow-Fever Commission arrived there, and for 19 of them he had been trying to convince people that mosquitoes and nothing else transmitted yellow fever.

Henry Carter, an army surgeon stationed in Mississippi during a mild epidemic of yellow fever, had recorded some interesting observations about the strange behavior of yellow fever during the early stages of an epidemic. There was, he said, an unexplained time lapse between the first reported case and the resultant outbreak. Two or three weeks might pass before a second person developed any symptoms of the disease. But after that a rash of victims would be stricken all at once.

The Commission went over its own statistics and found that they agreed with Dr. Carter's: one case, deceptive peace for about two weeks, then havoc. This state of affairs strongly suggested what the bacteriologists called "an intermediate host." Suppose that a yellow-fever victim — just one — is brought into town, on a ship, for example. Suppose that a passing mosquito bites the victim, thus drawing into her stomach the yellow-fever germ. Suppose that the germ incubates and is conveyed some days later to the salivary glands of the mosquito. From here on, everyone it bites is liable to the disease.

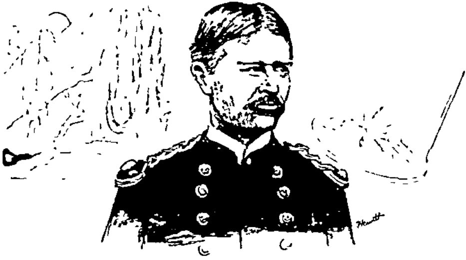
It now became abundantly clear that the claims of Dr. Finlay were due for some first-class investigation. Dr. Finlay himself was pleased but not surprised that the Commission had finally got around to calling on him. Never, he knew, had he expounded his favorite subject to a more important audience. Reed and his associates left, carrying Dr. Finlay's good wishes, all his collected literature on transmission by mosquito in other diseases (such as malaria), and a bowlful of mosquito eggs which he was cultivating. The Commissioners incubated and hatched these eggs into a fine collection of mosquitoes. The *Stegomyia fasciata* (now called *Aedes aegypti*) Dr. Finlay believed to be the guilty species—specifically, the female.

Now, proving the mosquito-transmission theory was, in principle, a simple matter. One would simply allow a mosquito to bite a yellow-fever victim, have the same mosquito bite a healthy man, and then sit back and wait for him to get yellow fever. How could any man, however, especially the gentle Reed, take such responsibility with human life?

But in the recent war with Spain, only 862 men had been killed in battle, and 106 had died of wounds. But 5,438 people had died of disease —typhoid and yellow fever leading the list.

The clinching argument to use human guinea pigs was that yellow fever could not, at the time, be produced in animals. Therefore human beings must be infected with it. Volunteers would have to be called for, but the first volunteers, the Commission decided, would be the Commission itself.

While they were making their initial plans, Reed had to return to the



1851 MAJOR WALTER REED 1902

States on medical business He promised to return as quickly as possible, leaving his three colleagues to begin Operation Mosquito.

The insects, hatched from the eggs presented by Finlay, had fed, one by one, on the blood of yellow-fever patients at the Las Animas yellow-fever ward in Havana. Lazear, a mosquito expert, had charge of the brood. He kept each of them in its own gauze-stoppered jar, each jar labeled with the date on which the mosquito had bitten a patient and the stage of the disease at the time.

Lazear and Carroll quietly corralled a few volunteers. Dr. Lazear made the first experiment on himself and some of his friends. Agramonte, to his own annoyance, was immune, having had the disease in childhood. The technique was simple. One lured the mosquito into a test tube, inverted the tube over the arm, tapped the bottom of the glass to call the attention of the creature to the treat at the other end, and let her bite.

To Dr. Lazear's disgust, no one got yellow fever. Could they be naturally immune? Or had his mosquitoes been too recently infected to pass along the disease? He wondered On August 27, 1900, he took Dr. Carroll into the laboratory and showed him a mosquito which he considered the prize of his collection This insect had bitten not one but four yellow-fever patients, the first of them 12 days ago The cases had ranged from very mild to very severe. If any mosquito of his breed was ripe for action, Lazear asserted, was it.

Carroll rolled up his sleeves thoughtfully watched the as she slid down the tube

on his arm The night after, he wrote to Reed. "If there is anything in the mosquito theory," he said, "I should get a good dose."

He did. For three days his recovery was a matter of doubtful conjecture. Lazear was frantic with worry, but he had produced the first experimental case of yellow fever by the bite of a mosquito. Carroll rallied, and soon he was out of danger.

Lazear, Agramonte, and Carroll, conferring at the latter's bedside, were jubilant. Further success had come to them from the mosquito. Lazear had allowed her to bite another volunteer, obliquely referred to in their reports as Case XY (actually a young private named William Dean.) Case XY also contracted the disease, but he threw it off with less difficulty than 46-year-old Carroll.

Two cases of mosquito-transmission! . . . Lazear's heart was filled with strange affection for his brood. Reed would be back soon and then things would really start popping! The young man's head was buzzing with ideas for procedure and practice. A week later he was dead of one of the worst yellow-fever cases the hospital had ever seen.

• • •

Reed, Carroll and Agramonte got back to work. They had two cases to work with, but one of them, Carroll's, was not [illegible]

fever in the Las Animas hospital for weeks. How did anyone know that the mosquito bite had anything to do with his attack?

But Mr. XY was something else again. He had been in the hospital at Camp Columbia for two months, and there was no yellow fever at Camp Columbia. Lazear's mosquito had been the only source of infection to which he had been exposed.

On the basis of his present knowledge, Reed took two decisive steps. He wrote a paper to be read at an American Health Association meeting in which he stated categorically: "The mosquito acts as the intermediate host for the parasite of yellow fever." And he applied to the Military Governor of Cuba for an appropriation large enough to carry out one large-scale piece of research, so perfectly controlled that not even the most violent anti-mosquito, pro-*fomites* men could quarrel with the results.

This was the origin of Camp Lazear, which became the official testing ground of the Commission. But would there be anyone around on whom to experiment? Reed himself was the only member of the board left who was not immune. He was anxious to try one of the mosquitoes on himself, but it was not practical to do so until he was sure that operations at the camp were running smoothly. Fifty-year-old men, he knew, did not make quick recoveries from yellow fever, assuming that they recovered at all. The military governor of Cuba, General Wood, had promised appropriations large enough to pay volunteers for their services, and this information was spread through the barracks and among the native population.

WALTER REED

WALTER REED, head of the U. S. Army Commission whose work (June 25, 1900-February 4, 1901) established the mosquito transmission of yellow fever, was born at Belroi, Va., on September 13, 1851. His father, a Methodist minister, and his mother, were of English ancestry. After private-school attendances, he entered the University of Virginia at 16, received his medical degree there in 1869, and earned a second M D. at Bellevue Hospital Medical College the following year. He interned at Kings County Hospital in Brooklyn, and worked on the health boards of that city and of New York

In June, 1875, Reed was commissioned assistant surgeon with the rank of 1st lieutenant in the United States Army. He was married to Amelia Lawrence the next year, and had two children. After some 11 years of garrison service in Arizona, he studied at Johns Hopkins, where he specialized in bacteriology.

Reed became a major in 1893 and was appointed curator of the Army Medical Museum and professor of bac- [illegible]

buried in Arlington National Cemetery.

The day after the news made the rounds of Camp Columbia, Reed was visited in his office by two young hospital corpsmen named John Moran and John Kissinger. They had heard about the Major's need for volunteers. They would be willing to help out.

Reed was amazed. He said, "I admire your courage, boys. I know that you both understand exactly what you're letting yourselves in for." They nodded. "In any case, I'm glad that we have appropriations to compensate you for your services. It's not much, considering. But—one hundred dollars if you don't get yellow jack; two hundred if you do We—"

"Major," Moran interrupted, "we weren't figuring on anything like that. In fact," he added more decisively, "we wouldn't want to do it if we had to take money for it."

Reed sighed, and said simply, "Gentlemen, I salute you." Of these two he wrote later, "In my opinion, this exhibition of moral courage has never been surpassed in the annals of the United States Army."

Camp Lazear was not much except an open field on which seven tents were pitched and two small houses were built The permanent personnel housed by this unlikely post numbered 15. Three of them were the remaining members of the Commission, three more were staff men known to be immune to yellow fever. They represented the link between Camp Lazear and the outside world.

From the day of its unceremonious opening, the experimental station was under strict quarantine. No one could come into it but its immune members, its nonimmune members could leave it whenever they cared to, but once they went out they could never return. All the people inside were known to be free from yell fever infection at the time the experiments began. Nor were any mosquitoes on the wel!

windy field except the specially bred laboratory insects trapped in the Commission's test-tubes. As of December 5, 1900 at two o'clock in the afternoon, Camp Lazear was the one spot in Cuba absolutely guaranteed to be safe from yellow fever.

Agramonte, stationed at the yellow-fever hospital in Havana, was in charge of mosquito-infecting. He had an inexhaustible source of supply. In the Las Animas ward there were men in every possible stage of the disease. Agramonte himself transferred the insects from the hospital to the camp, his pockets bulging with test tubes. Once in camp, the bugs were removed to artificially warmed quarters, were coddled and catered to as no mosquitoes in history had ever before been pampered.

Kissinger was the first of the volunteers to be bitten. The camp waited, no one more eagerly than Kissinger, for the incubation period to pass. He remained in roaring good health. A second try, with the same mosquito, produced no results.

"What do you think it is, Major?" the soldier asked him one day. "Is it me or the mosquitoes? It must be me I'm probably immune."

"Not necessarily. We have a new idea on the incubation period required now that the weather's colder. Let's try it again. This time we'll really do the job right. Five mosquitoes—they all bit yellow-fever cases over two weeks ago"

"Anything you say, Major," the boy agreed, grinning broadly.

Three days later, Kissinger was exhibiting all the symptoms of yellow fever. He was removed to the Las Animas hospital and every local yellow-fever authority was invited to come in and look at him.

It was a good case—unmistakably yellow fever, but mild enough to make recovery certain. It was all that the camp could have asked.

• • •

While Kissinger had been waiting to be stricken, another sort of experiment was under way at the camp. Proving that the female *Aedes aegypti* spread yellow fever was only half the job. Proving that the traditional *fomites* did not transmit the disease was the other half. Orders passed from Reed to the Las Animas hospital, and some days later three mysterious wooden boxes were delivered to the camp and deposited in one of its small houses.

It was an ugly little shack, 14 by 20 feet in size, its walls two boards thick, its heavily-screened windows shuttered and guaranteed to prevent good ventilation A double-doored vestibule admitted one to this unpleasant little home which came equipped with a coal-oil stove and a temperature of 90 degrees. Building Number One, as it was called, contained nothing but the stove, three army cots, and now the contributions from Las Animas. A volunteer doctor and two hospital-corps privates went in and broke open the crates.

For two weeks the boxes had been packed tight with soiled linen and blankets from the yellow-fever hospital. Special pains had been taken in the packing of these boxes. Not just ordinarily dirty linen passed the

rigid examination. These sheets had to be stiff with the black effluvium which gave the disease its popular name, *el vomito negro*.

The three men dumped the contents of the boxes onto the floor, then shook out each object thoroughly, in order to "spread" the yellow fever with which the mess was supposed to be loaded. They had volunteered for the *fomites* experiment and they would stay with it. And if any *fomites* in the world could produce yellow fever, these were the *fomites* to do it.

They made up the beds with the linen and blankets, crawled in between the sheets and waited for morning. It is not to be supposed that they slept. Next morning they were conducted to the quarantined tent where they were to spend their days during the experiment.

This was on November 30. Until December 19, 21 days later, the three men returned to their reeking house with each sunset and stayed there until morning.

On December 19 the three heroes were released from further dealings with *fomites* and were observed under quarantine for five days. After that they were allowed the run of the camp, not a flushed face or a racing pulse among them.

Two more volunteers took up nightly residence in Building Number One, under similar conditions, but with an added touch. These men wore the very pajamas that had belonged to yellow-fever victims. And 20 days later they were succeeded by two others who slept on pillow cases soaked in the blood of assorted yellow-fever victims.

Of the whole experiment Reed wrote simply, "The attempt which we have made to infect Building Number One and its seven nonimmune occupants during 63 days has proved an absolute failure."

The second house at Camp Lazear was similar to Building Number One in size, but in no other way. It was well ventilated; it was furnished with nothing but steam-disinfected articles; its bedding was sterile; its residents were sent in fresh from

wire net, but its windows were arranged to insure good cross-ventilation. Into one side of the building were released 15 hungry mosquitoes. Shortly after, they were joined by John Moran, the second of Reed's first two volunteers. At the same time, two other nonimmunes entered the other side of the house and watched through the mosquito-proof wire while the more discerning of the 15 mosquitoes went to work on Private Moran. Three times that day, Moran returned to the house for the purpose of being bitten by the contaminated insects. Four days later—on Christmas day, specifically—Moran had a fever of 104.2°. The other occupants of the building remained in excellent health.

The filthy, reeking houseful of *fomites* had done no harm to anyone. In the antiseptic dwelling next door, a man had caught yellow fever. The case was proved beyond a doubt.

Inventions Patents Processes

Earthquakes on Discs

Actual tremors of major and minor earthquakes may be heard on a new record now generally available Titled *Out of This World*, the disc contains shock waves of quakes on one side, backed with a collection of unexplained sounds from the ionosphere on the reverse side Both subjects were recorded using laboratory data supplied by Cal-Tech and Dartmouth respectively. Except for the scientists involved, no one has ever heard either of these sounds before

There is a wide distinction between the sounds of falling buildings in an earthquake and sounds of the quake itself For this record the quake sounds were produced originally from the movement of a seismometer located in the Seismological Laboratory of California Institute of Technology in Pasadena, Calif , under the direction of Dr. Hugo Benioff.

The magnetic recording mechanism of this seismometer is in effect similar to a microphone in design. The sounds as recorded accurately represent the actual movements of the earth's crust at this point, from quakes in Madagascar, Hawaii, Mexico and California

This record, the first of its kind ever made, may find many uses according to Emory Cook, head of Cook Laboratories, Stamford, Conn., leading makers of high-fidelity recordings. Playable in the home on standard LP machines, it provides authentic sounds of quakes and ionosphere for the science-minded.

In addition it can provide researchers with data for further analysis in a form which is widely available. In the case of the ionosphere sounds it may well stimulate additional reports of valuable data from other locations.

Out of This World is issued in the 33⅓ LP version only by Cook Laboratories, Stamford, Conn. It is available directly from them or in record shops

Unbreakable Lenses for Eyeglasses

A new system of toughening normal optical glass by heat treatment, to the point where it will withstand repeated blows, has been developed in Britain

The treated glass is rigorously tested far in excess of official requirements, the tests including the dropping of a steel ball ⅞ths of an inch in diameter onto it from a height of some 4½ feet [illegible] ork- [illegible] ost [illegible] ner sent the makers a pair of eyeglasses with lumps of metal adhering to the lenses, one of which was cracked but still in place—the souvenir of a near-disaster when the wearer was splashed with molten metal. The heat-hardened lenses withstood the impact where ordinary optical glass would have been shattered, and saved the wearer's sight.

Garnet Created in Lab

Pressures far down toward the earth's core, now duplicated by the press that has produced genuine diamonds at the General Electric Research Laboratory, have proved to be the secret of another

of nature's jewel-creating processes.

Garnet, the dark red gem stone which occurs with the green mineral hornblende, has been formed from that hornblende by General Electric scientist, Dr. Robert H. Wentorf, Jr., one of the researchers who took part in the diamond-making venture. Dr. Wentorf has also reversed the process and changed garnet back to hornblende

Water is a necessary ingredient in the hornblende. Dr Wentorf found, but must be removed by adding a suitable material which will take it away in order to produce the garent crystals Temperature of about 2,200 degrees Fahrenheit and pressure greater than 375,000 pounds per square inch are the necessary conditions in General Electric's press, which is so built that high temperatures and high pressures can be achieved and held constant for long periods of time

You'll Be Wearing Peanuts or Salt

Have you ever considered wearing peanuts? Or natural gas and salt?

It's not such a strange idea, writes Jean Davisson in the *Chicago Sun-Times*. You now wear corncobs and coal, air and water, and think nothing of it. At the rate synthetic fabric research is progressing, you may soon wear even stranger things

The real revolution in clothing of this decade has come, not from fashion salons, but from laboratories.

Rayon, of course, is an old standby. More recently we've become acquainted

may be wearing are going into a British synthetic fiber called "Ardil." And the natural gas and salt, combined with air, are the ingredients of dynel, a new fiber which has properties similar to precious cashmere or vicuna wool.

Coats of Dynalure fleece are mothproof, nonallergenic, do not water-spot or develop odor when wet.

Some of the first synthetic fabrics were long-wearing and needed no ironing, but had little else in their favor. Then fabric creators learned that a blend of synthetics with natural fibers sometimes made a fabric that had all the good qualities of both

Now many top American and Parisian designers use synthetics.

Calking Compound for Metal Surfaces

Aluminum Handi-Calk, a calking compound containing aluminum-flake pigment, has been developed by Aluminum Co. of America, Pittsburgh, Pa, for use in buildings with aluminum-framed windows Blending with the aluminum frame, it is designed to cling tightly to the metal surface.

Aluminum pigment particles in the compound arrange themselves in parallel layers and also "leaf out," forming an aluminum-colored surface The surface layer reflects the chemically active rays of the sun to retard oxidation; other pigment layers exclude air and moisture, slowing drying out of calk The compound is marketed in a calking cartridge —*Industrial Laboratories*

Patent System 165 Years Old

Whoever uses a safety pin, answers a telephone, turns on a light, or regains health by a new "wonder drug," can thank United States patent law — 165 years old this year—for spurring American inventiveness.

Since April 10, 1790, the man who builds a better mousetrap has had th right to protect his invention by a contract with the United States Gove

Measuring only 4x5 inches, the unified battery-and-case is leakproof, and entirely sealed in steel with a reinforced steel ribbed top. It attaches to a removable twin light head with two simple insulated screw caps. To connect the battery and make the circuit, there are no wires to hook up or battery spring contacts to make. The electrical circuit is completed by the metal frame of the light head itself.

Protects Linoleum

Best Home Finishes, Eureka, Ohio, has announced the development of a tough, transparent, liquid bakelite dressing which housewives can easily apply themselves to linoleum and formica sink-tops and splash-boards. This bakelite coating dries overnight and forms a tough, elastic film over the linoleum and formica. It resists acids, alkalis, alcohol, soaps, detergents, hot water and even salt water. The product is being marketed as "Perm-A-Dress."

Motorized Wheelbarrow

Equipped with 4-cycle, 2½ horsepower, air-cooled gasoline engine the newest wheelbarrow, termed the "Workhorse" and manufactured by Worthington Mower Co. in Stroudsburg, Pa., can carry a full 400-lb. load with practically no work or effort by the user because the motor drives the two front wheels and the operator need only guide it. Inclines, so often a point of labor and extra effort are no longer a problem. The "Workhorse" rolls right up a 16-percent grade as though it were level ground, say the manufacturers.

Loosens Nuts and Bolts

Useful to home handymen is a new product, a non-oily penetrant for loosening corroded nuts or bolts and larger metal parts of home equipment which have become "frozen." The product, Puritan Penetrant, is more effecti than oils. It is fast acting and penetrates deeply. It is safe to use because it is nonflammable and does not over the work. An odorless chemi formulation, the penetrant was oped by Olin Mathieson C Corp., Baltimore, Md. It is avai for home use through service and garages in half-pint and pint tainers. The penetrant is app allowed to act for several minutes. work is tapped lightly and parts then can be disassembled with proper tools.

Designs on Walls

Do-it-yourself enthusiasts may soon be able to stencil multi-colored designs on the walls of their homes in double-quick time.

Carl J. Ernst of Milwaukee, Wis., has developed and patented a series of pastes in various colors that can be dry-brushed onto a wall through a stencil. The secret of the rapid decorating is that after the flat oil paint for the entire surface has been applied, it is allowed to dry until it has lost its tackiness. The stencil is applied and the pigment is brushed into the body of the paint. Mr. Ernst assigned his patent rights to the Bro-Kade Wall Finish Co., Inc., of Milwaukee.

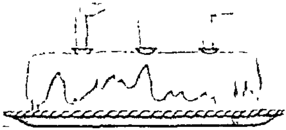
Hot-Weather Fan

[illegible]

others, employs a drive mechanism rather than gears. Four moving vanes inside provide a wide sweep, or they can be stopped to send the air in only one direction. A topside knob is turned to convert it from straight-blow to oscillating. It is made by Seabreeze-America Ltd., Buffalo, N. Y.

3 YEAR OLDS

KNOW GRAMMAR



A c[illegible] has learned about all there is to know about the basic ideas of [illegible] time it [illegible] 3 years old, according to research in linguistics done at the University of Illinois by Prof. Henry R Kahane, assisted by Mrs Renee Kahane, and Sol Saporta, graduate student

They conclude that most of learning to use grammar comes between the first and third birthdays After the third birthday, they found, learning of a language is chiefly the learning of additional words At a later date, school and reading may improve and refine speech habits but do not change the essentials of the use of grammar.

A child learns concepts such as time in three stages, according to the U of I. researchers In the first, it simply has experiences. In the second, [illegible] learns to express those experiences in the present tense In the third, [illegible] expresses the experiences in present, past or future tense, as the case may be.

The third stage in most instances is completed by the third birthday To the adult, the use of a language is largely unconscious habit

The findings, based on studies of language learning by French, [illegible] and American children, will be included in a chapter of a book [illegible] linguistics to be published next year

Sleep is deeper and dreams are shorter during the first few hours of sleep, two University of Chicago physiologists declared at a recent meeting of the Federation of American Societies for Experimental Biology.

Nathaniel Kleitman, professor of physiology, and William Dement, medical student, studied the depth of sleep through recording brain-wave activity.

The length of dreams was studied by electronically recording the eye movements during sleep that previous experiments have shown are associated with dreaming.

The sleep of some 16 males over a period of 43 nights was continuously recorded.

Study of the depth of sleep showed a succession of periods of deep sleep ranging over 60 to 80 minutes. The deepest sleep, as evidenced by the least brain-wave activity, was reached in the first period.

Sleep was progressively lighter during the next two or three periods.

The rapid eye movements associated with dreams were found to increase during periods as the night wore on. The first period averaged some 8 minutes of dreaming, then progressively increased to 16, then 22, and finally 24-minute periods of activity during sleep.

During the periods of eye movements which lie in between the periods of deepest sleep, the brain-wave patterns tend to resemble those found during waking moments The characteristic wave pattern of sleep, the "brain-wave spindle" was not present.

SCIENCE DIGEST

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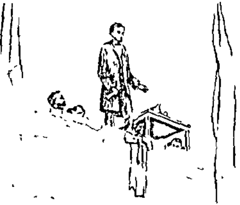
what this changing world means to

IPROVE YOUR MEMORY—p. 13

ARE SHARKS SISSIES?—p. 25



Capture Scenes of the Past?

If wire-tapping and secret tape-recording are alarming, consider this improbable possibility, by-product of discussions of the universe in the British science journal, *Nature:*

"To continue indefinitely receiving signals from distant galaxies of stars in the universe, an observer must be equipped with idealized instruments. (Idealized instruments, if they existed, could detect an infinitesimal amount of energy.)

"Peculiar situations would arise in everyday life if such instruments existed in actuality.

"It would be possible, for example, to observe the actions of a man long dead by trapping light from events in the man's life inside a box with perfectly reflecting walls, then releasing it as and when required."

This idea is set forth by Dr. F. Hoyle, astronomer of St. John's College, Cambridge.

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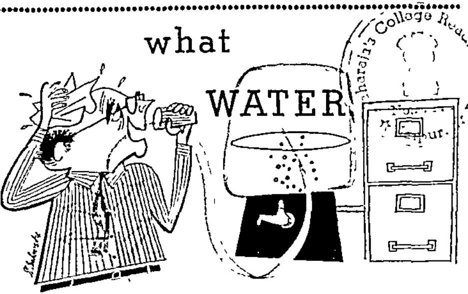

what WATER means to you!

by Norman J Berrill

Professor of Zoology, McGill University

Condensed from Maclean's Magazine

USING WATER that you can't tell from the kind that comes out of your tap, scientists are learning more and more about why you have to drink water to keep alive They're learning how and why the water passes through your blood, the dozens of different jobs it does, and what happens if you get too much or too little

What's helping them is "heavy water"—scientists call it deuterium—the substance that's used as a controlling agent in atomic-energy experiments It's worth its weight in gold, but your body can't tell it from ordinary water The only real difference anyway is that heavy water contains an isotope of heavy hydrogen—a hydrogen atom with an extra electron

In these experiments heavy water—either alone or combined with some other chemical—is swallowed, or injected into the blood stream. Then scientists collect liquid from sweat or urine, or they analyze tissues with a spectroscope, to find out what's happened to the de-
In this way they can trace the sage of water through the bod determine where it rests in th

While everybody knows that water is necessary to life, few people realize the actual extent to which we depend upon it. In fact, you are more than two thirds water by weight, even with your bones thrown in. When somebody calls you a "drip," that's not altogether a joke.

Heavy water was discovered about 25 years ago but it has been available in quantity for experiments for a comparatively short time. Now the scientists are able to tell exactly what happens to the water you drink. They couldn't follow ordinary water through the body, for there was no way of tracing its every move. They can spot the heavy water because of its difference in density and its different appearance on a spectroscope.

There are two ways of producing heavy water: it can be distilled off, for heavy water boils at a slightly higher temperature than ordinary water—but 13,000 tons of ordinary water have been distilled to produce less than a half ounce of heavy water; or it can be obtained by discharging electricity through ordinary water — under electrolysis the ordinary water disappears faster than heavy water.

Where there's no water, life is either absent, finished or suspended. Only our seemingly dry skin stands between our inner wetness and a liquid formless catastrophe. Brains ooze from a broken skull, for they are nearly 90 percent water and work best at their wettest. Six quarts of blood can leak from you if you should cut an artery. Blood, sweat and tears are all mainly water, and the tissues of your body are not much drier. Even the outer surface of the skin is moist. For the first nine months of your life, prenatal though it was, you were completely immersed in a water jacket. The wonder is not that we should have a water problem but that we should be able to walk about on dry land at all.

We need water simply to keep cool enough to live, to avoid burning up from the heat our bodies produce. We need water to keep our kidneys working. But above all we need water to renew what is already built into the living substance, whether it be heart muscle, brain tissue or blood cells, for in the body nothing is made once and for all.

We live only so long as we can renew what is continually being lost. We grow bald not because our hair falls out, for it has been doing that all along, but because new hair fails to grow in fast enough. And so it is with everything else. All the water in our cells and tissues is actually part of the living material for a time. It is forever leaving the cells and tissues and having to be replaced by new water almost like a slow stream.

No matter how much water there may be in your body at the moment, you cannot retain it. Water leaves your body whether you can replace it or not, and you can remain alive and comfortable only as long as the balance is maintained.

If the water leaves faster than it is taken in, you get drier and drier; and you dry out not only in the desert but as you get older.

And to make the whole business

more complicated and difficult, you have to keep the system operating at a certain critical temperature, neither too hot nor too cold. You need more water for this than for other purposes, for only by water evaporating from the body can enough heat be removed sufficiently fast for you to stay alive.

Keeping the body at the proper temperature is not a simple problem, though most of the time we manage fairly well. As in a modern industrial plant, the cooling system is most elaborate. As a rule most creatures, including man, can stand cold much better than they can bear excessive heat Our normal body temperature, for instance, is 98 6 degrees Fahrenheit but if it rises to 108 degrees we automatically die, simply because the substance of which we are made begins to undergo the kind of change we see in egg-white when we start to boil it

• Preconceived ideas are like searchlights which illumine the path of the experimenter and serve him as a guide to interrogate nature. They become a danger only if he transforms them into fixed ideas —René J. Dubos

Somewhere in our distant past we have become adjusted to tropical heat, but not without difficulty and with only a narrow margin of safety. Our temperature can drop to 68 degrees, however, without doing much harm. We would be pretty well unconscious and unable to move, but we wouldn't die and we would regain our activity as our temperature rose again. Everything just slows down as the temperature drops, and this is why surgeons sometimes "freeze" or cool the body of a patient before a heart operation so that the flow of blood is reduced to a minimum point.

The main trouble is that even when we are sitting down with our feet up we are still producing heat. Most of our muscles are never fully relaxed and as long as any muscle tension persists, as long as any oxidation processes go on in any of our tissues, we are burning oxygen and thus producing heat. As long as we live we are in fact burning as steadily as any flame—sometimes fast, sometimes slowly, according to the circumstances of the particular moment.

The difference is that if we get too hot the flame goes out Somehow the excess heat must be removed from the body. Evaporation from the skin in the form of heat and moisture breathed from the lungs is the chief means by which we accomplish this. For a lot of heat is lost when water changes from liquid to vapor during evaporation, and as long as sweat continues to evaporate, heat will be removed from the body surface

Any time you wet your finger and hold it up in the air to feel which way the wind is blowing, you prove the principle, for the moisture evaporates fastest on the side receiving the breeze and you feel that side of your finger get cold as heat is lost.

In a hot climate, even when you're resting, your evaporating system has to work hard to keep you cool to stay alive. Sitting still at 1 grees, whether in sun or the humidity at 40 p...

that of a nice dry summer day, a man loses nearly three pints of sweat *every hour. It is not surprising you* like to have a tall glass on the table by your side.

You may, of course, be much less fortunate and have to cut the grass no matter how hot the afternoon. Working at the same temperature in the sun, and with the humidity at 35 percent, you can lose nearly half a gallon of sweat in a half hour. You cannot keep up the pace without drinking gallons of water to maintain such a liquid turnover. In any case, such exertion is bad for your heart. If you are over 40, leave the lawnmower in the shed no matter how much the long grass annoys you.

On a humid day, with the air virtually saturated with moisture, you begin to sweat when the air temperature is only 80 degrees, and at 93 degrees, still several degrees below your body temperature, the whole body is covered with sweat. Water drips from the surface and perspiration fails to do its work of cooling the skin by evaporation At this point, if the air temperature rises without a drop in humidity, trouble is near and you had best start looking for a cooler spot.

Sweat, however, is not only water. It is a salt solution and as it evaporates and cools you off it leaves a deposit of salt on the skin. Days may pass before you have obtained enough salt from your food to restore the salt lost in this way and if you drink too much water too soon to compensate for loss of water, the result may well be a dilution of the blood. This doesn't do you much harm but certainly does not help you *to move around in your* usual lively fashion. You are likely to become literally waterlogged for a day or two, both mentally and physically.

As a rule, however, the kidneys can take care of any such excess of water, and after a single large drink the kidneys generally are working at their maximum efficiency within 30 minutes, and within an hour or so the body is back in water balance.

Nothing is more vital to our welfare than the action of our kidneys. If they should fail to function we would soon pass into a coma, as poisonous substances accumulate in the blood, and we would die within a short time, although we can get along with one kidney almost as well as with two. Sweating and lung ventilation take care of our temperature but it is our kidneys that are primarily in control of the internal wetness of our tissues and organs.

The history of the kidneys is complicated. They were formed in the first place to get rid of superfluity of water in the body and then later on were called upon to retain water in the body. And at all times they have been required to filter out poisonous waste substances produced by the wear and tear and general activity of the body.

First and foremost the kidneys are filters. Foremost because they were originally filters before they became anything else, and first because filtering the blood is still the first thing they do.

But something else goes on besides

the filtration process, for actually we lose only about three pints of water a day through the action of our kidneys. What happens to the rest? The process is simple enough but very effective. As the filtered fluid drains down the innumerable fine tubes within the mass of the kidneys, most of the water, salts and sugar it contains are drawn back into the blood channels. Only a small quantity of water, some salt, and most of the poisonous waste substance are allowed to pass on to become the urine. What oil-refinery engineer would or could devise a scheme whereby he threw out all the oil 16 times a day and grabbed back all but the impurities before it could reach the ground, with a loss of only 8 percent of the crude oil? Yet in principle and efficiency this is exactly what our kidneys do.

A man can as readily die of thirst adrift on the ocean as he can in a desert. When we drink sea water, it is so much saltier than ourselves that instead of water leaving our stomach and intestine and entering the blood, water is drawn from the blood by the stronger solution and we are worse off than before. It will not quench thirst, and drinking large amounts leads finally to madness and death.

How much water you as an individual need in order to stay alive and healthy depends somewhat on your size and sex and occupation, but whatever it is, the greater part is used for sweating from the skin and the surfaces of the lungs and only a small part for kidney operation. A quart of water a day takes care of the kidneys under any conditions, for with this surplus they can carry on their essential business, but soldiers, for instance, engaged in ordinary routine military activities, need at least another five quarts simply to replace what is lost by sweating. That is to say an active man requires about a gallon and a half of water per day just to keep his system working. Most of it he has to drink, though some of it is in the food he eats.

For most people, considering our sedentary ways of life, something less than a gallon of water a day is ample to keep us comfortably alive, but it would not keep us clean and we would have to live very differently from the manner we take more or less for granted.

WHEN YOU fix your eyes straight ahead, you should be able to detect moving objects anywhere within an arc of 70 degrees or more to either side (almost a semicircle).—*Better Vision Instit*

The RATTLESNAKE: Fact and Fiction

by Frank W. Lane

Condensed from Country Life

FORGET for a moment your instinctive dislike of snakes and consider the rattlesnake as a remarkable piece of natural engineering. Its backbone consists of 200 or so ball-and-socket joints, the actual number varying with the species, of which there are nearly 30. The joints make the snake so flexible that it can be wound in close concentric circles until it becomes a reptilian pinwheel. A rattler can be tied in a knot and it will glide out of it by the simple method of passing the knot along its body until it goes right off the tail.

The rattle which gives the snake its name consists of a number of loosely interlocking horny segments. When the tail is vibrated, these click against one another at some 50 cycles per second, the actual rate varying with the temperature. The resulting noise has been described as sounding like the dull buzz of a bumblebee and the hiss of escaping steam. The noise varies with the species. A large rattlesnake can be heard over 100 feet away.

The rattle is not always sounded before an attack. When hunting its prey the creature certainly does not advertise its presence, but it generally sounds its alarm when something capable of injuring it—such as

Country Life (Dec 9, '54); published and copyrighted in England

man or horse—comes too close for comfort.

Incidentally, the rattlesnake never hears its own rattle, because snakes are virtually deaf. Any sounds they "hear" are the result of earth-borne vibrations.

The darting tongue of a rattlesnake has nothing to do with stinging, or, as was once thought, with hearing. Nor has it anything to do with taste, for herpetologists, as the snake experts are called, say that snakes have no taste sense, their prey being swallowed whole The tongue is an accessory organ of the sense of smell.

As the tongue flickers through the air, or over an object, it picks up minute particles, and transfers them to two tiny cavities in the forward part of the roof of the mouth Here nerve-endings automatically interpret the odor message brought by the specks of dust.

A rattlesnake sometimes strikes a rabbit or small animal, then remains quiet for a time while the stricken animal moves away. The power of the poison is such that the rabbit cannot move far before it collapses. Later, tongue a-flicker for every trace of rabbit scent, the rattler follows the trail with the assurance of a bloodhound on the track.

A rattlesnake's fangs are two sharp, hollow needles about an inch long in the largest species. When the mouth is closed they lie folded back against the roof, covered with a white membrane.

The fangs are constantly renewed throughout the snake's life. A series of diamond-back rattlesnakes kept in captivity were observed to shed their fangs, on an average, every 20 days. The new fang is full grown, and ready for use before the old fang breaks away.

What happens when a rattler makes its strike? As the snake lunges forward its mouth opens in a giant gape of nearly 180 degrees (The most you and I can manage is about 30.) The two fangs are rotated forward ready for the strike. Simultaneously the protective membrane is partially pushed back, and the points of the fangs are bared. At the moment of impact the venom is pressed from the storage glands into the hollow fangs The snake has muscular control of the amount of venom discharged, and normally uses only a small amount in securing its prey.

Rattlesnake venom is one of the most complex protein substances manufactured by any animal gland The pale golden liquid still defies complete chemical analysis. It can be swallowed without harm, but when injected into the blood stream by the snake's fangs it plays havoc with the system

The lethal qualities of the venom vary considerably, being specialized for individual species according to their favorite prey Some rattler poisons primarily attack nerve tissue, others destroy the red blood cells. The most lethal venom is 60 times deadlier than that found in other rattlesnakes.

The most dangerous rattlesnake is the diamond-back. It gets its name from the pattern of brown diamonds

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along the middle of its back. Some diamond-backs carry 60 drops of venom, which is enough to kill quite a few victims without reloading. A giant diamond-back grows to 7 or 8 feet and weighs from 20 to 25 pounds. It is the heaviest of all venomous snakes, although the king cobra actually grows to greater length.

Despite the dangerous nature of their prey, a number of people in the United States make money out of capturing rattlesnakes alive. During one season in one part of Texas five tons of snakes were caught and sold. There are a few full-time snake-catchers, and there is an International Association of Rattlesnake Hunters with headquarters in Okeene (Rattlesnake Gulch), Okla. Live rattlesnakes fetch about 40 cents a pound, or a dollar a foot. An expert hunter might catch $100-worth in a day. The annual roundup at Okeene usually nets about $2,000-worth of live rattlesnakes.

Rattlesnake poison is used in the preparation of anti-venom serum and in medical research. The skins are used as fancy leather, and the meat is eaten. Canned rattlesnake is fairly well known in the United States. When roasted, the flesh is said to taste like chicken. Live rattlesnakes are in demand for zoos, carnivals, snake shows and pet shops.

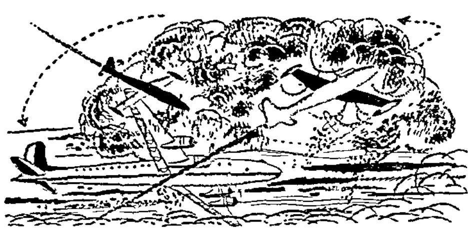
I once stayed on a farm in Oklahoma with two ardent rattlesnake hunters — Hugh and Zelta Davis. Hugh had been granted exemption from military service in the last war because he caught rattlesnakes. He commiserated with me on my misfortune in arriving just too late to go on the Okeene roundup.

He had twice been bitten. He said that the pain was "terrible." But he admitted both bites were due to carelessness. Some rattlesnake hunters get remarkably nonchalant with their dangerous prey. One man became famous for picking them up with his bare hands. With feet wide-spread he would lean over a snake, holding its attention by fluttering a handkerchief in his left hand. Then he would slowly lower his right hand until he could make a sudden grab and seize the creature just behind its head.

There is a widely-held view that a rattlesnake cannot strike upwards. It may well be true that most rattlesnakes do not, but that some of them can do so has been amply demonstrated by Walker van Riper of the Colorado Museum of Natural History.

Van Riper has taken scores of photographs of rattlesnakes striking at balloons. Among these are several shots showing a rattlesnake bursting a balloon held directly overhead. And, again contrary to belief, they can strike without the hind end being coiled, and they can bite without striking and still inject a dangerous quantity of venom.

Many rattlesnakes are caught in the early spring when waking from hibernation. They are then sluggish, and can be found fairly easily in rock crevices and small caves. Occasionally hundreds of snakes will hibernate together.



They Play Tag with Atomic Clouds

by Raymond Thompson

Condensed from the Baltimore Sunday Sun Magazine

A SELECT GROUP of young men from the Air Research and Development Command are cloud hunters. Their "game" is the massive, rolling radioactive clouds that result from an atomic explosion.

They track the potentially dangerous mass, often for hundreds of miles, so that they can notify the test organization when it heads toward airline routes or populous areas.

They also pluck off samples of the nuclear cloud — brown and reddish particles of dust and nitrogenous matter — so that Atomic Energy Commission scientists can make radio-chemical analyses.

That the cloud might shift in wind currents and turn on them doesn't really bother the airmen In their brief brush with it, they are subjected to less radioactivity than they would get from an average X-ray exposure.

"It's hunting at its best," says Col. Alden G. Thompson, an Air Force officer who has been doing it in this year's nuclear tests at Yucca Flat, Nev.

Colonel Thompson, a West Point graduate with 150 World War II combat missions and a Japanese Zero to his credit, is chief of the test operations division of the Directorate of Operations in the ARDC, with headquarters in Baltimore

"You read and hear so many tales of the deadliness of the atomic cloud and its radioactivity that you ... say the least, apprehensive the time," Col. Thompson admits.

"The scientists line up at

Baltimore Sunday Sun Magazine (May 1, '55), Baltimore 3, Md.

ing session and tell you there's no danger if you will follow their instructions carefully. In fact, they almost guarantee it. They assure you that it takes heavy exposure to get a harmful dose of radiation.

"Just the same, you're scared.

"But after a few hours of playing tag with the cloud you lose your fears and you become—well, blasé. It's really not as bad as you had imagined. You feel no different flying through that ominous-looking cloud than through nature's own clouds"

The planes and crews that follow each radioactive cloud are from the ARDC's Test Aircraft Unit and the 4926th Test Sampling Squadron stationed at Indian Springs Air Force Base, Nev

For the tracking missions, several types of plane are used. B-25's track the stem of the clouds, covering the level from 10,000 to 13,000 feet. The larger B-50's track the mushroom of the cloud at 30,000 feet. After the cloud has passed, a C-47 makes hair-raising flights just 500 feet above the jumpy Nevada terrain to measure ground fallout levels.

In addition to the tracking planes, there are F-84 and Martin B-57 jets which zoom through the mushroom cap at near-sonic speeds to collect samples of the cloud. Radioactive fission particles in the cloud are trapped by filters in specially designed wing tanks, for study by scientists.

The plane crews start their mission just after the cloud is born in a tremendous flash at Yucca Flat. Within minutes, they are either zooming through it or probing its edges and the aura of radiation that frequently extends beyond it.

The "trackers" speed toward the cloud and enter it in a flying pattern arranged so that when radiation is reported the plane can make the shortest possible turn to get out of it.

The planes approach the cloud at a 30-degree angle. After barely penetrating it they bank off at a 90-degree angle, make a wide curve and come in at another 30-degree angle, off at 90 degrees and another curve, and repeat this over and over until the cloud completely disintegrates

Information collected on the speed and direction of the cloud and its stem is sent to the Radiological Safety Headquarters, which makes a map of the area in which fallout occurs and details the intensity of the fallout. This information is relayed to the Civil Aeronautics Administration, public health officials and other interested agencies.

Besides the information on fallout gathered from the planes, headquarters also is in radio contact with 1[illegible] monitors in towns surrounding the test site. Fallout data are collected and persons in their zones are advised of the possibility of fallout.

There also are telemetering devices which report radioactivity by telephone, and other stations with automatic equipment which are checked every three days.

If the cloud passes over an airline route, the Civil Aeronautics Administration is notified and it, in turn, warns private and commercial planes

to stay out of its path until any possible danger is over.

Each time the nose of a tracking plane goes into the atomic cloud, gamma particles start through the plane's metal skin and the bodies of the crewmen, activating at the same time the needle on a Geiger counter. An officer watching the radio-detection equipment keeps close check of the radiation, noting the intensity and flight direction and signaling the pilot to turn quickly out of the cloud if the radiation becomes too heavy.

Pocket dosimeters provide crew members with on-the-spot information as to the accumulated dosage of radiation received, and film badges worn on their uniforms keep a permanent record, showing after laboratory development exactly how much radiation the airmen have been exposed to.

Actually, the exposure is minor because the flyers have only brief contact with the cloud itself. The Department of Defense and the AEC have set a 3.9-roentgen limit on total radiation which may be received by pilots in any test series. Only a fraction of this figure is received by the flyers on any single mission.

Army Chemical Corps tables show that some persons exposed to 25 to 50 roentgens of radiation would suffer a temporary lowering of the blood's white cell count; that 50 percent of the persons exposed to 450 roentgens would die, and 600 roentgens would be fatal to 100 percent.

• The problem of what man will do with the enormous possibilities of power which science has put into his hands is probably the most vital and the most alarming problem of modern times.
—Julian Huxley

The low safety tolerance of 3.9 roentgens eases the minds of the tracking pilots when it is compared with the Chemical Corps' tables.

Besides, all the pilots have to do to flush away any lingering effects of radiation is to take a shower immediately after each flight. Even the plane, more contaminated than the crewmen, can be made safe for another flight just by a washing-down.

Men in the sampling planes are subjected to more radiation than the trackers because they must fly through the atomic cloud itself. But even this exposure is far below the maximum permitted to the pilots.

Getting cloud samples — and the pilot — out of a heavily laden radioactive plane is no easy task.

The job is handled by a small group of nuclear technicians, all Air Force personnel, who remove the pilot with a forklift that raises a wooden platform to the level of the cockpit. The pilot steps onto the platform and is lowered to the ground as the forklift pulls away from the contaminated plane.

Through this system, the pilot does not touch the outside of the plane; this eliminates the risk of exposure to even more radiation.

The cloud-saturated filter is removed with long-handled tools designed by the AEC's Los Al[illegible] Scientific Laboratory.

Cloud sampling has not al[illegible] been done with manned

While "tracker" planes have been used to follow clouds and chart their path ever since the United States began its first atomic tests in 1945, drones were used for sampling until January, 1951.

In that month, a volunteer group of Air Force officers made the first sampling flights. Three of these men are now at the ARDC headquarters in Baltimore.

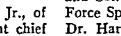
Colonel Joseph J. Cody, Jr., of Arlington, Va., now assistant chief of the Atomic Operations Division at the headquarters, was in charge of that volunteer group.

Believing that manned planes could do sampling safely, yet faster and more cheaply than drones, Col. Cody and his group made the pioneering flights during "Operation Ranger," using WB-29 planes.

The aircraft and techniques have undergone considerable improvement since then. B-36's, F-84 jet fighters and the Baltimore-built B-57 have replaced the WB-29's.

Credit for the improvements in sampling and tracking techniques is given primarily to Col. Paul Fackler and Col. Karl Houghton, of the Air Force Special Weapons Center, and Dr. Harold Plank, of the Atomic Energy Commission.

These officers and the men who fly the tracking and sampling planes, are building up a fund of knowledge that could mean the difference between victory and defeat in the event of an atomic war.



Heat Hard on Cows

Hot, sunny weather is harder on cows than on humans The heaviest cows suffer most, except for the Indian Brahmans

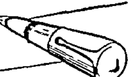
The reason cows suffer from the heat is that they cannot perspire and so get rid of heat The heavy breeds, such as Holsteins, suffer more because they have less skin area per pound of weight and so have greater difficulty ridding themselves of the sun's radiated heat.

Brahmans, a heavy breed, come off better than the lighter Jerseys because of their big ears, dewlaps and navel flap which act as "built-in radiators." The extra area helps dissipate heat.

Tests showing how breed affects heat tolerance and why were made by U S Department of Agriculture engineers and dairymen of the Missouri Experiment Station at Columbia, Mo.

The tests showed that hair color has some effect on an animal's ability to tolerate radiated heat, but more significant was the ability of the cows to change the texture of their coat as temperatures increased. Coarse shaggy hair was replaced by fine, glossy hair that absorbed less and reflected more of the sun's radiation. The lighter hair of Brahmans, Jerseys, and predominantly white Holsteins reflected more radiated heat in the visible-light spectrum, but the predominantly black Holsteins showed excellent ability to reflect invisible infrared (heat lamp) radiation.

How To Build a Better Memory



by Colin Peters

Condensed from Town Journal

SO YOU CAN'T remember names and dates and errands? Well, I can: I've just taken a course! And if *you* think you've got a poor memory, believe me that just isn't so. Your mind can store 600 memories a second for a lifetime of 75 years and still feel no strain. You've got the equipment, all right—maybe you're not using it well For memory is like reading and writing—we can all do it; but with training we'll do it better and faster.

• • •

Perhaps you'd like to be able to repeat the names of 50 people you've just met and recall some personal detail about each? Well, that's just one standard graduation exercise after only ten lessons at a New York memory-training school! And with practice, you could even match one graduate of Bruno Furst's school who can recall the catalog number, specifications and list price of 20,000 items in current production.

How does he do it? Of course, he uses a system. But that's not all. Memory systems can improve recall by 200 percent to 400 percent. But they won't do the work by magic. You'll never recall anything unless you've memorized it properly at first. The classical "absent-minded professor" doesn't forget his umbrella as he leaves He forgets it as he arrives! He's thinking of his lecture, sets the umbrella down automatically—and forgets to note this fact.

The whole secret of a good memory is "remembering to remember"—concentrating on the details in the first place with the conscious idea that you'll want to recall them later. When this becomes a habit—you'll have a good memory. Then you'll really be able to use the various memory systems that have evolved over the past 400 years.

As refined by Dr. Bruno Furst, director of the School of Memory and Concentration (365 West End Ave.) in New York, the art of memorizing and recall boils down to six ru! Let's apply them to the problem plaguing most names and faces Suppose

Town Journal (May '55), 230 W Washington Square, Philadelphia 5, Pa Copyright 1955

met Tom Bell, a department-store salesman, and you've arranged to lunch with him in a week. You're afraid you'll forget the date or the man or his name or his job Well . . .

1. *Concentrate on what you want to remember.* Every waking moment, our mind is absorbing impressions by sight, sound, touch, taste and smell. We'll forget 90 percent of them because our senses skim them. (Quick —without looking—what's the color of the wall nearest you?) You must select what you want to remember—at least at the start, until memory becomes more of a habit—and then study it. Now, most people forget faces because "It's rude to stare." Well, it's even ruder to forget someone So take a good look at Bell. Ask his name again if you didn't catch it; it's a mark of interest.

2. *Find a reason for remembering.* We all know small boys who struggle desperately with arithmetic — but can reel off baseball batting averages. Baseball makes sense to them because they're interested. So with Bell: Why are you meeting again, why does he or the date matter to you? Is he a fishing expert with tips, a potential friend perhaps—or maybe a friend of your boss? Think about Bell in this light, to help the details stick.

So much for concentration — to sharpen your memory. Now to make sure that the memory stays with you.

3. *Repeat what you want to recall.* The young baseball statistician, so psychologist William James noted, thinks often about baseball and each time unconsciously reviews past games and scores. Repetition anchors the memory. (See if your wife remembers your home phone number! She may not — because she rarely uses it.) It's certainly not hard to repeat Bell's name at your first meeting: "Glad to know you, Mr. Bell!" "Do you care for sugar, Mr. Bell?"

It's also useful to recall Bell and the date several times in the week between meetings. By spreading repetition over several days, you'll fix the memory with less effort.

4. *Don't write it down!* "Memory is like a muscle," Dr. Furst preaches. "It becomes stronger with use" I was the world's greatest note-taker—had 'em in every pocket, even in my hat band. One day, I took a chance, applied the Furst system—and remembered 14 downtown errands without a note. If you make a jotted note of the lunch with Bell, you'll be less inclined to bear it in mind. And then you're also less likely to look the reminder up in your notebook when the time comes!

Concentration and repetition will sharpen and anchor the memory. But how to pull it out again when you need it?

5. *Visualize an association around a notable feature.* The trick is to attach a handle to the memory before letting it sink: "That fat lady's name is Mrs. Ful(l)ton." There's no point in remembering just a man's name or just his appearance; the thing that matters is to connect the two in your mind. Now, it happens that Bell has an oval sort of face topped by a crew cut; the outline is

like an inverted bell. Think about it: next time you meet, the name will recall the face or vice versa

Think the name Bell is too easy as an example? Try imagining Jack Warner sweating ("warmer"), Helen Hayes forking hay into a barn, Clark Gable mending a gabled roof. The more ridiculous the association, the better it works. Magazine writer Maurice Zolotow reminds himself to mail letters by visualizing the friend to whom he's written sitting naked atop a mail box. Then, when he passes a box, and "sees" his stark friend on it—he drops in the letter.

You can develop the association to include other data—say the fact that Tom Bell works in a department store Visualize (the mental picture is important) a bell on sale in such a store. But there's a better way:

6. *Fit the memories into a pattern.* One memory should lead to all the other things you want to recall. In Bell's case, all the details may connect with the reason he matters to you; otherwise, you could create a pattern — say a little story that brings in all the necessary references. Or let me tell you about my jaunt to the drugstore a few weeks ago.

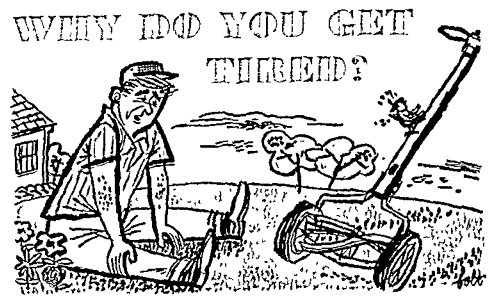
I had to buy cigarettes, candy, powder, a magazine and toothpaste. I thought of the word "compact" (and ran through what it meant a couple of times as I drove down)—then bought *c*andy, *m*agazine, *p*owder, *c*igarettes, *t*oothpaste. I'd created a pattern to link these unrelated items. You could create a pattern for a longer list—say a week's groceries—by grouping all the dairy items, then all the vegetables, etc., so that the store's various counters are your "chain" for recall (and if necessary have a word or story for all the items within each group).

"Chain recall" works because the mind doesn't store words but impressions. You don't recall just a man's name and face but his total impact on your consciousness. And anything else that happens when you first meet him, perhaps the smell of his cigar. Any one detail (say the smoke of a similar cigar) is thus enough to trigger recall of them all.

Now, all this may sound cumbersome And certainly you'll have to push yourself at first to put "handles" to memory. But you'd be surprised how soon it becomes an unconscious habit. Then suddenly you're free—wonderfully free of the tyranny of the scribbled reminder . . . the shred of paper you can't afford to lose, the panic when you do! You'll be making up your own devices for recall, built around your own memory needs and faculties.

For you are not limited to the systems outlined here. Nor to the others Dr. Furst details in his personal and correspondence courses and in his latest book, *Stop Forgetting* ($3.50, Garden City, 575 Madison Ave., New York) There are special, easy systems for remembering numbers, speeches, odd facts, professional data. But to use any of them, the first step is up to you: Make a habit of remembering to remember; tice by trusting your memory. ory's a pretty wonderful f. you use it right.

WHY DO YOU GET TIRED?



by Clifford B. Hicks

Condensed from Popular Mechanics

SURPRISINGLY LITTLE research has ever been done to find out why you get tired The obvious answer, of course, is that working makes you tired, but what actually takes places inside your body when you become "plumb tuckered out"? Is there a change in your breathing, your pulse rate, the chemicals in your blood stream, the amount of oxygen you extract from the air you breathe? How utterly "beat" can you become?

The DuPont Co. has decided to find out the answers, and a research program in fatigue is now under way at DuPont's Haskell Laboratory for Toxicology and Industrial Medicine near Wilmington, Del. In charge is physiologist Lucien Brouha.

"Even we physicians can't agree on a definition of fatigue," says Dr. Brouha "Basically it's a tendency toward inactivity. Most of us suffer from one of three types of fatigue—physical, mental or nervous. Unfortunately we can't yet measure the effects of mental and nervous fatigue. But with some precision we can measure physical fatigue and its effects.

"It's obvious that the man who wrestles big castings is spending a lot of energy. It's not so obvious but equally true that the filing clerk, the bank teller and the housewife also spend a vast amount of energy in one day's work. Some day we may be able to measure accurately the effects of nervous and mental fatigue, but meanwhile we are trying to find out

what makes people dog-tired and what we can do about it."

Doctor Brouha likes to use a figure of speech in discussing fatigue. "You have a 'bank account' of energy which you build up by deposits to your credit whenever you rest. As you work, you make withdrawals from your account. If you withdraw more than you put in, you eventually overdraw your account. At that precise point, exhaustion sets in."

To determine where this point occurs, Dr. Brouha is running some unique experiments with a small platform invented by Lucien Lauru, a French engineer. Only two such platforms exist, one at the Haskell Laboratory and the other in France. The platform does a job that has never been done before—it measures the energy expended by anyone who performs work while standing or sitting on the platform.

For decades time-and-motion engineers have measured the *useful* work a man performs. A man who raises a 100-pound bag two feet does 200 foot-pounds of useful work. But to Bouha this figure is misleading, for it doesn't include the work the man does in lifting the upper half of his body the same distance, the work expended in stopping the movement of the bag, or the effort required to move it sideways. Brouha measures total work, not just useful work.

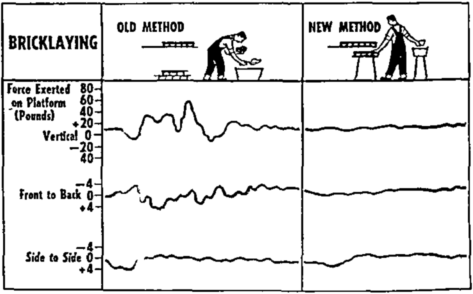
The Lauru platform is so sensitive it can measure the energy a rat puts forth in running across it. Triangular in shape, the platform is built up of three layers. Between layers and at the points of the triangle are extremely sensitive crystals. Under pressure these crystals give off tiny electrical impulses. The three layers measure vertical movement, side-to-side movement, and front-to-back movement. Thus the platform will record the force necessary to produce a movement in any direction.

The crystals are linked through an amplifier to a recorder. Results show up on a sheet of graph paper that rolls along under three moving pens. Each pen shows movement in one of the three directions.

A subject is placed on the platform with the tools he needs to perform his job. The platform then is "zeroed" to make him weightless, so any motion he makes will activate one or more of the three pens. If he stands motionless the pens draw tiny bumps showing his heartbeat. If he lifts a heavy bag from the floor and places it in another position, each pen fluctuates violently.

"Most people fail to realize," says Brouha, "that they perform a lot of work just in moving themselves in addition to moving their work. We place a person on the platform and give him a four-pound weight to lift above his head. The recorder shows that he lifts much more than four pounds because he is also lifting the weight of his own arm.

"Furthermore, a great deal of energy is spent in stopping a moving object, even if the movement is upward. For example, a poorly coordinated man can actually spend more energy in stopping the upward motion of a weight than he did in starting it upward in the first place." ➤



During its "break-in" period the platform turned up some surprising facts about ordinary chores. A man painted a ceiling from the platform. He was followed by a woman who ironed a shirt. The graph showed that the woman was putting forth twice as much work as the man Another surprising fact· a stenographer, in filing papers in a four-drawer cabinet, works twice as hard as the housewife ironing a shirt.

The platform shows that you can do a lot of work just "playing." Serving a tennis ball, for example, requires twice the work of hoisting and moving a 50-pound bag from one position to another.

Research with the *Lauru platform*, measured in terms of pounds, shows that a mason puts forth 61 6 pounds of effort to pick up a trowel of mortar and a brick. Raising your arms above your head and lowering them takes an expenditure of 62.5 pounds.

A soldier expends 276 pounds doing a quick deep kneebend and, to the amazement of the research workers, he uses less than that to straighten up. In this type of measurement even a piece of paper can be heavy; an office worker spends 15 4 pounds just picking up a sheet from the lower drawer of a desk.

Such research isn't just theoretical. A bricklayer stood on the platform with a pile of bricks and some mortar at his feet. When he started laying a wall the three needles waved all over the graph paper. By the simple expedient of placing the bricks and mortar on a scaffold at *waist level, the needle lines were* evened out into gentle curves—a tremendous saving in energy.

Eventually Brouha and his staff hope to analyze a good many of the ordinary jobs of DuPont workers as

well as others. They'll come up with specific recommendations for modifying jobs to eliminate wasted effort and fatigue.

The platform also may become a valuable tool for fitting a man to a particular job No two men, placed on the platform, do a job in exactly the same way. The fewer and smaller the wiggles on the graph, the better suited is the man for the job.

Research with the platform is just one of several ways in which Brouha is pinning down the causes of fatigue. He also is determining the effect that *temperature, humidity and clothing* have on workers in specific jobs, and discovering physical reactions that can signal the approach of fatigue.

If you were to peek through the observation window into one of the two all-weather rooms at Haskell during an experiment, you'd see a startling sight. Pumping away at the pedals of a bicycle (without going anywhere) is a man literally covered with instruments.

One of his arms, suspended in a sling above the handle bars, is wrapped with a band that takes a continual reading of his blood pressure. A clamp over his nose forces him to breathe through his mouth into a tube. A valve in the tube opens to let him inhale fresh air, then closes to shunt the air he exhales through instruments which measure the amount of oxygen he has extracted and the amount of carbon dioxide he is exhaling.

Devices strapped to various parts of his body measure his temperature, and other instruments record the amount of perspiration on his skin.

Every 15 minutes Dr. Brouha rushes into the room and draws from the subject's arm a sample of blood, which is immediately checked for changes in blood chemistry. The subject's heartbeat is broadcast through a loudspeaker.

Volunteers, all laboratory technicians, go through the pedaling routine three times at three different levels of temperature and humidity. Few are able to finish a sprint with the temperature and humidity both high.

After the subject has been pedaling for some time, Brouha will tell you to watch two pen lines on a recording graph. "If the two lines meet, the subject will stop through sheer exhaustion," he says Sure enough, just as the lines come together the subject stops pedaling and shakes his head to signify that he can pedal no more.

Of what value is such research? By finding out exactly what goes on inside a man's body while he works, Brouha hopes to pin down the exact causes of stress and to show employers how they can eliminate those causes and still get the work done.

One simple and excellent index of fatigue is the heart-recovery rate. At the end of a given work period, a worker is told to sit motionless while his pulse rate is taken at 1-minute intervals for 3 minutes.

Ideally, at the end of the third measurement the rate should be to normal. But in jobs which re too great an expenditure of the heartbeat rate stays

even on the third count. The normal rate, though it varies widely, is about 72 beats per minute. A rate of 150 after 3 minutes of recovery indicates fatigue with the possibility of exhaustion.

Another check is the worker's temperature, which may slowly rise to a high of 101 or even 102 degrees toward the end of a hard day's work. Brouha now can tell when a worker is overtaxed to such a point that if he continues, he'll slide down the hill to utter exhaustion.

Brouha's research with heart-recovery rates and temperatures among workers of the Aluminum Co. of Canada, Ltd., before he joined DuPont, has enabled him to pin down a very definite "gripe line" on his graphs. When any worker's heart-recovery rate stays at 110 beats per minute at the end of the first minute following work, he invariably begins griping to anyone and everyone about his job—and with good reason, for he is well on his way to fatigue.

Heat and humidity have a tremendous effect on fatigue. In any type of physical work, the higher the temperature above 40 degrees Fahrenheit the greater the stress on the worker. In one experiment, a manufacturing plant was kept at a temperature of 40 degrees and workers were able to perform 11 full cycles of work without showing any high reactions.

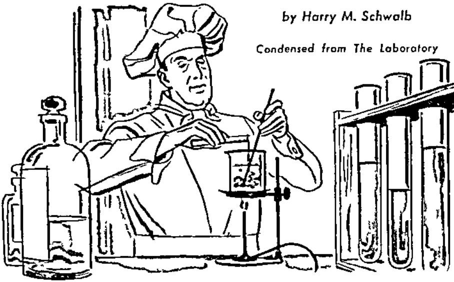
Later the same work was performed by the same group at a temperature of 82 degrees and, even though rest periods were frequent, the men were unable to perform more than 8 cycles of work. And furthermore, tests showed that the men were rapidly approaching the danger point in fatigue.

This temperature-humidity research has led to the development of an air-cooled suit designed for hot, humid work. A flexible tube runs into the suit. Smaller tubes branch off to the arms and legs from this main artery. They have holes about one inch apart. The large tube is connected to a source of compressed air which blows through the tubes, emerges through the holes, balloons out the suit and escapes through the material itself and around the neckband.

In one test with the suit, a man rode the bicycle in the all-weather room with the temperature at 110 degrees and the relative humidity at 65 percent. After 30 minutes of pedaling, his heart-recovery rate was excellent.

Then the air to the suit was cut off Even though he remained motionless, his pulse rate shot up from 108 to 130 beats per minute. He was instructed to go back to work without the air supply, and his pulse rate skyrocketed to 162 beats per minute. At that point he became so dizzy he almost fell off the bicycle.

The suit is one development from the research at Haskell, but more important are the hundreds of graphs and the thousands of calculations that are piling up day by day. Fact upon fact is filed neatly away in cabinets, and from these cabinets may come techniques that will help eliminate fatigue.



by Harry M. Schwalb

Condensed from The Laboratory

WONDERS of FOOD CHEMISTRY

Excited squeals and angry yips pierce the evening mist as spindly-legged, swollen-bellied children pick through the street garbage, fighting with the dogs for edible morsels. Before the year's end there wil be the usual 25 deaths from hunger or the compounded effects of malnutrition, in the tiny village in Central India . . .

Maybe Dr Ezra Stone had this scene in his mind's eye as he swallowed down his strange dinner in a Beltsville, Md, laboratory several thousand miles to the west: pure capsules of a new weed poison called 2,4-D.

Three weeks of these daring "meals" and he established that the spectacularly powerful chemical would not harm human beings Applied in microscopic amounts, it stimulates plant growth; in larger doses it so *over*stimulates broadleafed weeds that they burn up their food reserves and die.

Now , based on the way pointed out by 2,4-D, chemists are working on selective poisons which do not harm, let's say, corn, wheat or soybean seedlings, but do kill everything else. Simply mixing such compounds with fertilizer, farmers will one day watch crops grow in 100-percent weedless fields. . . .

At present, half the world's 2 4 billion people do not have enough to eat. A century from now the wor will hold 8 billion people. T growth, without precedent in the

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tory of mankind, is a nightmare to students of population.

That is why the chemical industry "has come to dinner," matching its resources against the specter of Hunger. At last report, things look better than anyone has dared hope.

Chemists have already helped farmers two ways. First: a growing variety of chemical fertilizers since World War I has upped the fertility of our soils In the U.S , fertilizers alone have raised crop yields some 20 percent.

The second way chemicals have boosted crop yields is in the growing stage of the crops. Here "pre-emergence" treatment of the soil keeps weeds down until the young plant gets a healthy start, while many chemical dusts and sprays have been designed to keep in check the 10,000 insect enemies that attack our vegetables and fruits.

Still other chemical treatments enable crops to ward off more than 6,000 different plant diseases. Biggest news here: antibiotics, only now emerging from research into the commercial stage and offering hope in areas previously written off as defenseless. Reason: they act right inside the plant tissues, where bacteria are best licked.

Chemicals are even making farm plants smog-proof. Coating the leaves with certain chemicals protects even the

and poultry larder; hens are now mass-vaccinated against Newcastle disease. And synthetic hormones in cattle-feed increase fattening as much as ¾ pound per day. Aureomycin, terramycin and penicillin do likewise for chicks and young pigs.

Just as more — and better — food has been produced by farmers through chemistry, whopping benefits for the consumer have come about from the use of chemicals by food technologists to make just about every foodstuff cleaner, tastier or more nutritious than it was a scant generation ago.

Once food scientists established that foods are no more than combinations of chemical compounds, they were able to fix the identity of some 60 different substances as necessary to support human life at peak efficiency. Today they can duplicate in the laboratory, and then on a large scale from cheap abundant raw materials, many of the amino acids (the building blocks of proteins), vitamins, minerals, flavors, and colors of natural foods.

Generations of lab animals have been raised to full vigor on these carefully-compounded chemical diets. That man with his food customs and tastes would ever take to such a diet is—outside the pages of science-fiction—pretty unthinkable. But compounding chemical diets where every ingredient can be accurately measured is a valuable tool in nutrition research.

Results: starting in 1924 in the U.S , the addition of a little iodine to table salt has drastically reduced the number of people with goiter. The increasing use of milk with man-made vitamin D protects today's

child against rickets. Chemically-produced vitamin C has given us a potent weapon against scurvy.

Chemicals keep our food safely stored until needed, play a vital role in holding down the ravages of pests and rodents in the granary, and protect food against bacterial contamination, mold and rancidity.

In the food processing plant, chemical detergents wash produce and keep the equipment spotless, while a variety of wrappings of chemical origin guard against dirt, fungi and bacteria in the food's long journey through the distribution channels to the table.

Baking technology, based on new data gathered by cereal chemists, is now able to control fermentation so that dough can be "custom modified" to produce loaves of the uniform size, shape and texture the consumer demands. A method of tenderizing beef has been developed which cuts treatment time from 3 weeks to 44 hours

Thanks to the chemist, fresh fruits and vegetables know virtually no season. Refrigeration begins right in the field and continues to the point of the retail store. Wax coatings reduce shrinkage and control deterioration in fresh citrus fruits.

Nearly every American adult now consumes with some regularity foods that were strangers to him in his childhood — exotic items like avocados, artichokes, boysenberries, broccoli, zucchini squash. A whole new world of canned, frozen and dehydrated foods has appeared on the market since World War II, so varied and, above all, so convenient to use, that the average American housewife has been clocked at preparing all her family's meals in 2 hours, 20 minutes

Fastest growing sub-science in this particular field is "food physics" — the development of physical methods for measuring such elusive qualities as "body," "bloom," "sweetness," "astringency," "bouquet." Automation . . . radiation sterilization . . . ultrasonic processing . . . continuous process control . . . "food physics" is, in 1955, here to stay.

Of course, the progress of science towards bringing enough food of the proper varieties to the rest of the world will be more gradual. In the meantime the chemical industry is doing much to relieve the distress of inadequate food supplies. Already a process for low-cost palatable fishmeal for human consumption—formerly a product about as tasty and as fragrant as castor oil—has expedited emergency feeding in Indonesia and Central America.

Brightest hope: the use of chemically-produced nutritive substances to make up for diet limitations Today, throughout the Orient, rice is the chief food and energy source for the great masses—polished white rice, stripped of vitamin-bearing bran. Adding B vitamins and iron to the East's rice would cost 35 cents per person per year, and cut beriberi deaths 67 percent within 12 months!

Even more vital to the F teeming millions is the upping their animal-protein intake (

simply isn't enough land there to do it by husbandry). In the wind now are plans for (1) folic acid factories, to enrich food in tropical countries where anemia is prevalent; (2) production of vitamin B_{12} to increase child growth in the lowest animal-protein regions of South Asia; (3) large-scale synthesis of lysine, methionine, threonine, tryptophane, and the distribution of these essential amino acids.

Even in the generally well-fed U.S., enrichment of flour, corn meal, corn grits and bread has almost wiped out the South's pellagra, and now some 360 U.S. communities are adding sodium fluoride to their water supplies to reduce one of man's most common maladies: tooth decay.

Perhaps the most dramatic long-range project of all is "Operation Algae."

Agricultural crops convert only 1 percent of the sunlight into food energy. Leaves do not cover all of the acreage exposed to sunlight; growing periods are limited to a few months; most of the energy absorbed is used to draw water from the soil into the plant.

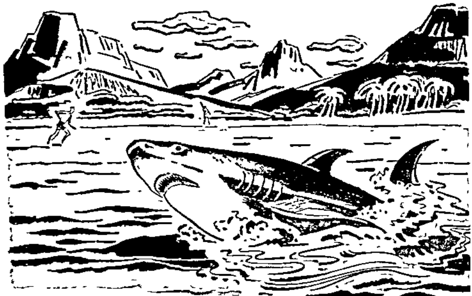
With the tiny one-celled plants called algae, on the other hand, scientists have achieved virtually perfect efficiency in converting light energy into chemical energy.

What does this mean? Where most agricultural crops produce one to three tons per acre per year—including stalks as well as grain—Stanford Research Institute men have been able to grow algae at the rate of 50 tons per acre, and even this harvest can be upped fourfold. Thus, a 1-acre algae farm of the future may well be the equivalent of a 100-acre field of wheat or corn. And the algae will be "lab-designed" for high protein, high fat—whatever the geneticist desires.

Another attack on the problem of getting the mostest from the leastest sunlight was victorious at the end of 1954 when University of California researchers uncovered the exact process whereby green plants make food. From spinach they isolated the chlorophyll-bearing particles called chloroplasts, and made them perform—for the first time in history—outside the living cell.

Thus, chemistry stands just about at the threshold of synthetic food production by practical means. "Artificial photosynthesis" would mean a rise in the future importance of desert and tropical areas, would almost certainly mean the use of solar energy to run factories and heat homes. Above all, it would bring closer the day when the swollen bellies due to hunger will be a memory.

HOW MANY MOLECULES in a single bacterium? Something like 1,000,000, with the tiny organism capable of manufacturing them at the rate of 21,000 per minute. These computations were made by the late Dr. O. L. Sponsler of the botany department and Dr. Jean Bath of the University of California at Los Angeles Medical Center —*Science Service*



ARE SHARKS SISSIES?

by Raymond Schuessler

"SHARKS are the most vicious creatures in the sea and will upset small boats to kill and eat man," say some deep-sea veterans While others scoff, "To keep off a shark it is only necessary to make an aggressive move toward it . While sharks are armed to tear any animal or fish to pieces, they are cowardly like all scavenger fish . They are merely swimming garbage-disposal units." And so the controversy continues to rage. Are sharks sissies or are they not?

The truth about sharks seems to lie midway between these two schools of thought. The shark at times has been known to be a savage mankiller, while at others he has been a sniveling sissy It all seems to depend on the species of shark, his mood at the particular moment, and on the territory of water.

The great white shark, the most formidable creature in the sea, definitely will attack on sight and take a human being. This brute spends most of his life offshore feeding on porpoises and sea lions. If a human should come close enough, the shark undoubtedly would make a meal of him On the other hand, the whale shark which grows to a length of 60 feet is harmless to mankind. H feeds on microscopic fishes and not even kill a larger fish.

Every variety of shark the waters off the coast of

and the Gulf of Mexico where millions of vacationers bathe. These waters are supposed to be the safest in the world. Yet shark attacks have occurred here. Although only a few incidents have been reported in recent years, this does not mean that sharks are not liable to make an occasional meal of a haberdasher from Hackensack if they were hungry enough.

Lifeguards, unlike the Chamber of Commerce, can tell you many hair-raising stories. I have personally seen a 10-foot tiger shark within 40 yards of shore at Palm Beach, and a 14-foot hammerhead shark within 40 yards of shore at Riviera Beach. At the far end of Crandon Park Beach in Miami I have seen a battle between a giant sting ray and a mako shark not 30 yards from shore. At Juno Beach in 1953 a shark ripped a woman's leg from thigh to ankle as she stood in water up to her waist.

Sam Barrows, who was a lifeguard at Palm Beach for 40 years, wears a gold medal as proof of the fact that sharks will attack people. It was back in 1931, on a peaceful sunny afternoon, that a young girl, Gertrude Holaday, who was swimming about 150 yards from shore, screamed painfully. Sam dived in, taking along a line and buoy. As he reached the girl, he saw a grinning 13-foot hammerhead shark, which after ripping the girl's right leg, was maneuvering to make another attack upon the bleeding girl.

The lifeguard grabbed the girl and kicked furiously at the slick, jabbing and *feinting* monster now crazed with the taste of blood. At any second both might be cut in half. People on the beach began hauling in the line, some running with it up on the beach hoping to haul away the human meal from the hungry shark. "The shark made three passes at the girl before we reached the beach," Sam recalls, "each time barely missing the arm and the leg of the girl. I was most afraid he would circle in back and come at us from the rear."

Onlookers who saw the entire Roman-arena sort of battle said that the shark followed the couple all the way into the surf, and they thought for sure it would come up onto the sand after its victims. The girl spent seven weeks in the hospital, requiring 228 stitches. She recovered, but you cannot ever tell her sharks are sissies.

In another attack some years back, a man and young boy were swimming about 150 yards offshore near Woods Hole, Mass., in water 12 feet deep, when a shark grabbed hold of the leg of the 16-year-old boy and took him underwater. After some time the boy broke away from the shark and was rescued by his companion, but later died from the injuries.

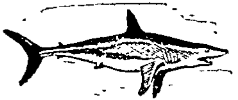
Maybe a shark will only attack if hungry. But these 500- to 2,000-pound bodies are hungry most of the time and they are always hunting food. Sometimes they hunt in small packs like wolves, and like wolves will in turn rend and devour any of their pack that gets hurt. A brown shark caught off Key West, Fla., after a recent plane crash in which four men were lost, was dissected

and found to contain the body of a man

The greatest danger of shark attacks exists when a person swims alone during the autumn. This is the time great schools of mullet travel south along the coast and sharks come into quite shallow water to feed on them. A few years ago, Horace Chase of Palm Beach was standing in waist-deep water when a school of mullet moved by him. A shark which evidently had been feeding on the mullet, ripped one of his legs open from hip to ankle Chase managed to crawl ashore where a passing motorist saw him and rushed him to a hospital. He recovered

There have been cases of sharks actually developing a fetish for human flesh Back in 1916 a "mad shark" terrorized the northern New Jersey coast by attacking five people in a period of ten days. On July 2, at Beach Haven, one man was attacked and killed Four days later, 20 miles farther north, another man was killed. Six days later, 20 more miles north, a shark entered Matawan Creek and attacked three people, killing a boy and a man and biting another boy's leg off. Two days later a 9-foot shark was caught in a net off South Amboy In its stomach was a mass of human flesh and bones. There were no more attacks after his capture.

Sure, that was a long time ago. But why should these killers change? They have not changed much since they began to swim in seas 100 million years ago, except in size. Fossil remains show that sharks in those



MAKO SHARK, or "Blue Pointer" has a long, pointed snout; its back and sides are colored an iridescent blue

days grew to a length of 100 feet and had jaws so large that six men could stand upright in its mouth. And if their ferocity has diminished also, you cannot prove it.

However, it is known that for every shark attack in Florida or Caribbean waters, there are 10 to 15 incidents in Pacific waters. In Sydney, Australia, for instance, shark attacks occur a frightening number of times. In Australia, many beaches are considered so dangerous that steel nets are constructed to protect bathers.

Near Port Stephens, New South Wales, a shark swam 15 miles up a river to grab a small boy enjoying a swim, and actually started out to sea with him. Another boy jumped into the water, grabbed the side of the shark and held on The surprised shark dropped its victim and swam away. The little boy died from shock and injury. His gallant rescuer was awarded a medal of valor from the late King George.

Here is the opinion of Australian Don Linklater, president of U- seas Products and member of Underwater Explorer's Club of tralia: "There are all kinds of I have swum close to

HAMMERHEAD SHARK, with eyes at extremities of its hammer-shaped head, may weigh up to 1,500 pounds.

would not go away, some that fled easily, and found others sneaking behind me while I waded in shallow water. I have spoken to native pearl divers without arms and to skin divers with horrible scars. When we here in Australia are cynical, a shark will kill someone or bite a hole in a boat One thing I know, sharks are most active at night, and the most dangerous daylight time seems to be when the seas are cloudy and the skies overcast."

The wide divergence of opinion probably exists because sharks, like people, have different personalities and moods. Because a shark off Key West was frightened by a pink handkerchief released by a diver does not mean that all sharks will be so frightened, or that this same shark will be frightened again by the same device.

The skin-diving fraternity boasts of its immunity from shark attacks but one suspects a public relations finger behind this key. Here is an account of an aqualung diver in the Red Sea "There were four of us; we had descended to about 20 feet when suddenly about 30 yards off, a 5-foot shark caught sight of us. In a split second he rushed toward me. I was unarmed, and even if I had a weapon I would not have had time to use it. Fortunately he swerved when he was only about 3 feet away. Everything I had heard about sharks then was suddenly disproved. He was not cautious, he attacked deliberately and he maneuvered beautifully. It was I who could not avoid him, if he meant to have me."

Skin-diver Gerd Schulenberg of Ceylon says, "In ten years of professional spear fishing, I have encountered many sharks, and one thing I have learned about them: never take them for granted. They are one of the sea's greatest dangers, because they are more a potential rather than an actual danger to a diver, which leads to a disregard for them that can be fatal."

The prima donna of the deep is an unpredictable creature. Savage and cunning fighters at times, yet when captured, the biggest problem is how to keep the shark from committing suicide. A shark in captivity just wants to die. If special attention is not given him, he will sink to the bottom of the tank and try to suffocate himself and end it all.

At Marineland, Fla., expert fish handlers have a special job of keeping captured sharks alive. Only by constant motion will the handlers be able to keep the gills working, so they take the shark by the fins and swim the fish around the tank thus giving him artificial respiration.

Even after he has been coaxed out of not breathing, his will to die stays on and he will now go on a hunger strike. Not a drop of food will he eat, until at last in about six months he dies.

But it is known that in his own environment the shark is one of the most durable and tenacious of creatures. I've seen a 10-foot tiger shark pulled up on shore, gutted, and a half hour later kicked back into the water, and off he swam! And another was gaffed, gutted and shot, and still bit off the hand of a careless crewman.

Some insist that shark attacks usually result from accident or mistaken identity on the shark's part. One shark attack, on Captain Kemp, at Palm Beach who had his heel bitten off, was made in murky water and it is possible that the shark mistook the movement of his foot for a fish

But how can you explain the 17-foot man-eating shark that was killed only recently in the Adriatic Sea? Found in its stomach were four men's coats, a woman's nylon blouse and a gold ring. Several persons along the coast had disappeared just before the shark was captured. What the people were doing in the water with their clothes on wasn't explained.

So, are sharks sissies? One sun-wrinkled veteran of the sea offered a 50-dollar bill to a young skin-diver who boasted that "All you have to do is poke a shark in the nose and away he'll run," to go down in murky water unarmed off the Florida Keys

"Well . . . uh . . " stammered the cocky diver, "there's no sense in proving it that way."

So maybe some sharks will avoid human swimmers, but if you think all sharks are sissies all the time, come on down and I'll show you a reef where some 10- and 12-foot mako and tiger sharks play and feed and I'll let you prove it.

Moon Was Formed at Low Temperature

The moon was formed at a low temperature and there has never been sufficient radioactive material there to warm it enough for melting Dr Harold C Urey of the University of Chicago told the National Academy of Sciences

Evidence for this is the moon's bulge of about 9/10ths of a mile which points toward the earth, he said If the moon had as much radioactive material as has been thought, Dr. Urey said, the bulge would have long ago smoothed out.

Scientists estimate the moon's radioactive material from analysis of the cosmic fragments that fall to earth as meteorites These estimates are about three times too high, Dr Urey believes The lower values for abundances of potassium, uranium and thorium he suggested would account for the high rigidity of the moon

The new, lower values would also account for the uniform composition of Mars, he said

If the figures for abundances of radioactive materials are not reduced . least three times, Dr Urey pointed one-half the outer crust of the would have melted in the last lion years

NEW WORLD OF ELECTROCHEMISTRY

by Waldemar Kaempffert

Condensed from The New York Times

DIAMONDS flashed again in the news recently—artificially produced diamonds. The diamonds were unimportant. Much more important were the discoveries made in the effort to produce them.

The news about this development came from Dr. Leandro Tomarkin, a biochemist, who is the director of the Vitron Research Corp., Spring Valley, N. Y., which is developing the principles of Mario Vilella.

The Vitron researchers said nothing about their work until last February, when the General Electric Co. announced that it had produced artificial diamonds (1/16th of an inch long at best). Dr. Tomarkin then came out with a statement that artificial [illegible] nor the Vitron Research Corp. sees any present commercial use for minute artificial diamonds. The cost is too high. But even a commercially useless accomplishment may have important results. So it proved to be in this case. Out of the efforts to make diamonds comes a new development of electrochemistry.

A DIAMOND is pure carbon in a particular crystalline form. Change the crystalline form of graphite into that of the diamond and the problem of making diamonds artificially is solved. This seems easy in theory. In practice it is difficult.

Pressure alone will not change graphite into a diamond. Prof. P. W. Bridgman of Harvard has found that when the graphite changes to something almost as hard as a diamond but which is not yet a diamond it resumes its original form when the pressure is removed. High temperature as well as high pressure is needed if the change is to be present.

The simplest way to exert high pressure is to force a piston into a cylinder filled with material that is to be changed. It is not easy to maintain pressure that runs up to several hundred thousand pounds to the square inch without breaking the cylinder. But it has been done.

COMMERCIAL high-pressure apparatus is now operated at 50,000 pounds to the square inch. Prof. Bridgman has long been working at 150,000 pounds. His "hot ice" (it is much hotter than boiling water) was produced at 600,000 pounds.

Heating material in a cylinder to over 2000 degrees Fahrenheit can be done electrically. In fact it has been done over and over again in the past, in carrying out a process called "flash sintering." "Flash" indicates that the time is short (in Vilella's case, a minute or two).

The powder metallurgist takes metal powder, presses it in a mold, then heats, or sinters, it. Vilella's contribution to the art is an improved hydraulic press which makes it possible to apply high pressure and high temperature simultaneously. Metal powders, scrap, metallic shavings and turnings can be squeezed to theoretical density either in a vacuum or in an atmosphere that keeps out the corroding gases of the air.

Alloys have been made in which the lighter constituents can be heated far above the point at which they would ordinarily melt Some alloys of calcium, lithium, magnesium, sodium, potassium and zinc have been made for the first time So with various oxides, borides and carbides To produce silicon carbide, a pressure of over 100,000 pounds to the square inch is applied simultaneously with heat of 3800° F.

A process like Vilella's is needed to meet many important demands. Parts of jet planes must withstand high temperature. Unless they are produced, supersonic planes will not be developed rapidly. A titanium-aluminum alloy would go far toward solving the problem. Vilella can make it with his apparatus. Other ceramic metals can be made, and they will have their uses in many an industry. Vilella sees no difficulty in making titanium ingots from scrap at half the present cost.

AN entirely new world has been opened for exploration. It is a world with revolutionary possibilities Most chemical processes are carried out at low pressures and temperatures. But when the pressure runs up to hundreds of thousands of pounds to the square inch and the temperature to 2000° and even 5000° F., we enter a strange world where combinations occur that are impossible under ordinary conditions.

With the super-pressures and the super-temperatures that can be attained, this new world is bound to be explored with the probability that unheard-of compounds will be developed An experimentally-inclined industrial organization can ask even now for some seemingly "impossible" compound or alloy, with a good chance of getting it In fact, more than 100 different alloys have been produced in the Vitron laborat[illegible] for important companies.

A MAN who weighs 190 pounds at the North Pole would weigh only [illegible] pounds on the Equator because of the rotating earth's centrifugal f[illegible]

CHILDREN AND SCIENCE

Children ask more questions about science than any other subject, according to a nationwide survey conducted by the University of Illinois.

The survey included 6,313 pupils in grades four through eight, 4,531 parents, 212 teachers, and 169 librarians. It was directed by J. Harlan Shores, U. of I. professor of education. He found questions on science running two to one ahead of questions about other school subjects.

At the library, grade-school children are looking up information about science more than information in any other field, according to the survey. In reading choices, science subjects are among the top three.

Professor Shores says that the findings indicate that science needs are not being fully met and that the interest in the subject shown by grade-school pupils is not being fully exploited.

Other survey findings were:

As children progress through the grades from four to eight, interest increases in mystery stories and decreases in cowboy stories and fairy tales.

Boys, more frequently than girls, want to ask about the history of the United States, airplanes, rockets, and baseball. Girls, more frequently than boys, want to ask about horses, dogs, vocations, boy-girl relationships, ethics, values, and religion

Adults tend to overemphasize children's curiosity about sports and recreation, airplanes, jet planes, and rockets.

Parents and teachers underestimate children's interest in animals.

LINKS WORRY WITH TOOTH DECAY

Can worry cause tooth decay? There's a hint of it, says a Northwestern University psychologist, according to Arthur J. Snyder in the *Chicago Daily News.*

The theory has been unfolding recently that prolonged and intense stress tends to cause changes in body tissue—and that it may affect the teeth as well.

Here is the way the thinking goes according to Bernard Saper, Ph D., assistant professor of psychology.

When a person is worried, anxious, tense, frustrated or otherwise under stress, the cells of the body release a chemical: histamine.

This chemical attacks other body cells and more histamine is released in a short of chain reaction.

"If this formulation is correct, then we might eventually be able to link directly psychological stress with actual cell destruction in the teeth," says Saper.

"Though admittedly far-fetched at present, the thought is an awesome one."

COLLEGE SLANG

Slang has always been with us. It appears on a sliding scale of popularity which denotes immediately whether or not the speaker is "on the ball" or "out of it." The dialect quickly becomes archaic, as do fads in clothing, and to be so labeled is a fate worse than death to the hipsters (those in the know), notes Mary Ellen Parr in the Lawrence College (Appleton, Wis) *Alumnus*.

Although some words stay around for a long time, such as *snafu* (situation normal, all fouled up), *roger* (okay) and *over* (now it's your turn) from Army or Air Force usage, many change frequently — or the meaning changes during transition. What was "out of this world" year before last was "real gone" last year and is now "the greatest" or "the most." What was originally "hot" suddenly becomes "cool" and is now "far out"

"Out to lunch" refers to someone who, in other years, just wasn't "there"—and he is told immediately to "Get with it!" One who consistently falls below the set standard is "out to all meals." Such squares (or crates) - bug (bewilder or irritate) those who are hip (which was formerly "hep"—meaning in the know).

A hipster never goofs (makes a mistake) and always flips (gets excited) at the proper things His scorn can be indicated by saying "That doesn't quite make it," or "Later . . ." to anyone who has made a suggestion too unsatisfactory to consider.

"Crazy," meaning wonderful stayed around for a long time but has lost its intensity by becoming a casual remark in response to almost anything, even good-by. "Nutty" has taken its place to mean good, and "cool" which for so long was the essence of all that was just right as an adjective, has become a verb whereby one "cools" a thing by doing it well. On the other hand, it may mean just the opposite, depending upon the inflection used. Much of the meaning of slang is in the tone of voice, which readily indicates favor or disfavor

Adults have been "snowed under" by work, but so have students—with variations They are "snowed" when they are completely convinced of something and they "snow" an exam when they make a good grade They "take it cold," otherwise. They can even be snowed (convinced) by something under false pretenses, in which case they were gassed (favorably impressed) first and got hip later

They can goof (make a either by accident or design. first is, of course, embarrassi

to "goof off" is usually deliberate. It means to waste time, or to fail in any project on purpose. This seldom meets the approval of the troops (any group, particularly one's own crowd).

Perhaps the most colorful term is "clutch." It is a verb, as are "tense" and "panic," meaning to be nervous or upset before, during or after any occasion of importance.

In conclusion, even an egg-head (intellectual) can get hip if he's gassed by the gaff and adequately snowed by its importance. There's no reason to be out to all meals with the rest of the crates, clutching about trivia, when it's really easy to dig it.

RULES FOR GOOD LISTENING

How to speak clearly and effectively is the subject of innumerable executive-training courses. Comparatively rare, however, is instruction for the individual in how to listen, says an article in *Modern Industry*.

Because listening seems as natural as breathing, it has been necessary to prove that listening abilities differ. Doing research on this line, Prof. Ralph Nichols, professor of speech at the University of Minnesota, has compiled a list of eight bad listening habits:

• *Hop-skip-jump listening*. Average thinking time (400 words per minute) exceeds average speed of talking (125 words). The listener falls into the habit of taking outside excursions in thought during another's conversation. When his attention rushes back, he finds the speaker has got ahead of him. Correction: Use the extra thinking time on such a related matter as "What facts are not being brought out?"

• *Fact listening*. Attempting to spot "just the facts" can be confusing It's better to go after the main ideas and weigh facts against them.

• *Emotional deafness*. Words like "Communist," "red tape," "taxes," excite the listener and tend to deafen him to what is actually said. In planning embarrassing questions or a smart retort, the listener can miss the true point.

• *Premature dismissal*. Some listeners, feeling they know in advance that a subject will be boring or too difficult, close their minds. Yet, the most uninteresting subject often offers worthwhile ideas to chew upon

• *Pretended attention*. Some think they can get away with pretended attention. This is just a waste of time that seldom fools the speaker.

• *Criticizing speaker's appearance*. A lisp or rumpled clothing have little to do with the value of a talk.

• *Yielding to distraction*. Good listeners fight distractions by doing what they can to reduce outside noise, keep minds on what is being said.

• *Pencil listening*. One listens with the ears, not with a pencil, and note-taking seldom improves retention. The note-taker gets so involved in writing he often misses the sense, like

a proofreader looking for errors instead of for meaning.

HIGH BLOOD PRESSURE A FAMILY TRAIT

High blood pressure tends to run in families. For this reason, by studying the family history, doctors can spot the man or woman likely to develop a serious form of the condition.

These findings from a study of 799 persons over 40 years old are reported by Drs. Constance D'Alonzo, Allan J. Fleming and George H. Gehrmann of the E. I. duPont de Nemours and Co., Inc., in *The Journal of the American Medical Association.*

High blood pressure is more likely to occur in a person whose parents had disease of the heart and blood vessels than in one whose family had no such history It occurs most often when the mother was a victim of the disease.

"DRY DRUNKS"

Problems of the "inner life" are the most potent cause of the "dry drunk," Drs James A Flaherty, H. Thomas McGuire and Robert L Gatski of the Governor Bacon Health Center, Delaware City, Del, reported at a meeting of the American Psychiatric Association.

The "dry drunk," they explained, is a term used by alcoholics to describe an emotional state they must cope with while keeping sober over an extended period

Depression, impatience, intolerance, irritability, nervousness, occasional confusion and an irrational desire to resume drinking are symptoms of this state.

During a dry drunk, the former alcoholic tries to avoid people and is sarcastic and critical toward those who cannot be avoided.

The dry drunk may last from an hour to four months. The depression may be so great that suicide is planned. A "slip," or return to drinking, almost always follows.

Effective means of fighting the dry drunk are to attend meetings of Alcoholics Anonymous and to consult its members outside of meetings, the psychiatrists advise.

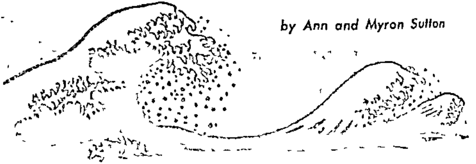
OBESITY CALLED NATIONAL TRAGEDY

That overweight persons are a "much more important national problem than polio" is the conviction of Dr Garfield G. Duncan, clinical professor of medicine at Jefferson Medical College, Philadelphia.

Doctor Duncan said that overweight persons are predisposed to such ailments as diabetes, heart trouble, hypertension, arterial sclerosis, and gall bladder disease.

"You can't get the drama into the problem of being overweight that is in polio," he said, in calling [illegible] national organization whose duty would be to make overweight popular. "Obesity is truly a [illegible] tragedy"

by Ann and Myron Sutton



When Waves Go Wild

In the celebration of *Sanno-Sai,* one of the three great Shinto festivals of Japan, happiness pervades the streets like a breeze. Banners flourish, and paraders in brightly colored kimonos and huge lion-head masks angle down the streets in gay processions.

In few places, perhaps, is the revelry as great as in the coastal Sanriku district, 300 miles north of Tokyo. Sixty years ago, on the evening of Monday, June 15, 1896, great crowds thronged in gaiety for the festivities. At 7:00 P.M., as ringing laughter sliced the soft Pacific air across Miyako Bay, a violent earthquake rocked the sea floor of the Tuscarora Deep, 700 miles to the northeast.

No one in the Sanriku prefectures seemed to notice. The *sake* and the celebration gave this night's twilight a dream-like texture, unpervaded by the curtain of care.

At 7:50 the sea, also unnoticed, slowly receded from shore, far beyond the limit of low tide. With the surf hushed, the seashore, but for the festival, became strangely and ominously silent.

As darkness closed in, a tremendous roar reached the ears of the merrymakers and they looked in terror toward the sea. By then it was too late.

The sea returned to Sanriku as a swelling, surging wall almost 100 feet high, crashing inland, sweeping a mingled mass of homes, towns and mankind into a raging, deafening torrent: 13,073 houses were destroyed, 27,122 lives lost.

Even for Japan, to which have come more than 2,000 major earth shocks, disturbances and catastrophes in the last thousand years, it was an enormous disaster.

What had happened?

At 2:00 A.M. on the morning of April 1, 1946, another violent subterranean shock jolted the ocean floor of the Aleutian Trench, 7[illegible] miles southeast of Alaska's Unimak Island. Immediately over the surface of the site a series of waves more than 100 miles long was set in motion spreading out like ripples in a pool

Almost identical to the waves that befell Sanriku, they gained momentum and headed south at speeds up to 600 miles an hour. Known to Pacific dwellers as tidal waves (though they have nothing to do with tides) these gigantic forces are normally so small and inconspicuous that they pass unnoticed beneath ships on the open sea.

But when they reach land, and the homes of man, it is another story. In the dark hours of this April dawn, 1946, the giant waves sped south from Alaska straight toward the Hawaiian Islands.

At six o'clock gray storm clouds scudded low off Kilauea Point. In small shore houses on Haena Bay some of the women were cooking breakfast. Sampans prepared to put off from the wharf at Pakala Most of Honolulu was sleeping and the tide-gauge in the harbor was making, as usual, its small, indefinite squiggles on the depth-graph Hilo's Kamehameha Avenue lay quiet under the leaden skies The palm trees on Cocoanut Island bent with the wind.

At 6:19 the initial assault wave struck the northern coast of Kauai. At the head of Haena Bay, two women, one of them carrying a baby, were standing in front of their houses when the water suddenly rose up around them. They swam to safety in nearby trees while their houses floated away and disappeared in the swirling waters

In less than an hour, the wave swept around all eight of the islands, leaving disaster in its path.

Yet no sooner had the force of the first wave subsided, when a new and bigger one roared onto the beaches, then another, and another, and still another. The Hawaiian Islands, caught by surprise, were being pounded by the worst tidal wave in their history

Powerful swells rammed into coastal settlements, demolished houses by the dozen and knocked over dense groves of pandanus trees.

Boats put out, as best they could, to rescue victims washed into the bay. The naval air service dropped lifeboats to survivors adrift in the turbulent waters.

At Hilo, destruction was rampant. Wave force, converging on the mouth of the Wailuku River, ripped out the railroad bridge there and carried one of its steel spans 750 feet upstream Most of the buildings along Kamehameha Avenue were either destroyed, damaged, or shifted, leaving the street a shambles.

On Maui, waves plunged over the breakwaters and roared into railroad tracks, cars and warehouses in Kahului Harbor Even Marine Corps amphibious tanks were floated away

Lawns and tennis court pavement were stripped off, and thousands of fish were swept up onto airfields and golf courses. Where reefs protected the shore, much of the force of the waves was broken, but in open unreefed shoreways the waves bore down upon the beach and plunged inland in a hissing, roaring, clatt ing pandemonium

No rolling sea wave of these nitudes is just a surge of hip

water; it is backed up by a terrific sea-borne force that packs a wallop wherever it hits.

And sometimes a freak wallop. At Kawela Bay, on Oahu, the wave's gentle lift carried a house inland 200 feet, floating it into a cane-field and setting it down with breakfast still cooking on the stove and dishes still in place on the shelves. Near Limaloa Gulch, waves carried one house along a shore ridge, dumped it, picked up another on the return and deposited it at the brink of high tide.

Fortunately, the heaviest concentration of population on the Islands —located on the south side of Oahu —lay protected from direct frontal attack. In Honolulu Harbor the tide-gauge went wild with sudden fluctuations but the water rose only four feet, and in Pearl Harbor even less than that. Few inhabitants in either place realized a wave had struck.

But in the Kolekole Valley a railroad trestle was collapsing and migrating upstream with the surge, leaving its bridge deck hanging by the rails

On Molokai the waves rose gently, pushing inland to an elevation of more than 50 feet, then flowed back to the beach with astonishing turbulence, undermining roadways, stranding launches, dashing tugboats against breakwaters, shifting buoys, washing away buildings, and sucking debris of all sorts into the deep.

Wave and sea oscillations lasted all day long — on what will probably be Hawaii's longest-remembered April Fool's day—but by mid-morning the violence had diminished.

Hawaiians fearfully surveyed the damage. Railroad tracks had been wrapped around trees. Eighty-eight hundred tons of sugar had "dissolved" from the Hilo docks. Bridges lay collapsed, concrete piers and abutments undermined, sugar mills ruined, plum and hau trees uprooted, taro patches destroyed.

Total property damage: $25 million. Casualties: 159 dead, 163 hospitalized.

Since oceanographers and other scientists were asembling in the Pacific at the time (for the Bikini atom tests) this back-door catastrophe became history's most closely-examined tidal wave.

To the seismologists, who preferred to call it a *tsunami* (Japanese for "cove waves"), it followed the pattern of tsunamis down through history.

But now the question was: Could anything be done to prevent loss of life and property from these oceanic deluges?

In the Pacific Ocean six prominent locations produce the majority of tsunamis. In order of importance they lie off the coasts of the Aleutians, Japan, Chile, Kamchatka Peninsula, Mexico, and the Solomon Islands.

Generated by violent sea-floor movements, tsunamis travel at terrific speeds for thousands of miles. The vigor of their attack depends partly on whether the coast in question is facing the direction of the sea quake from which the waves are coming.

These massive sea waves are con-

trolled by repellent forces. The submarine landscape helps spread and dissipate, or channel and ramrod the wave's force. If coral reefs are present, they break up the violence of the catastrophe. If there happen to be storm waves at the time, as in Hawaii's case, then the force is increased and likewise the devastation.

The shape of the shoreline can mean relative safety or sudden death. Headlands are not always badly hit. Bays often are, as are river valleys, which funnel the approaching waves into a small space, confining and thus magnifying their original turbulence

In most cases, the onrush of the waves is preceded by a slow and quiet withdrawal of water from the shoreline On the evening of November 7, 1837, the sea retreated 120 feet from Maui's Kahului Bay and the residents followed it gleefully down — delighted to catch the stranded fish and explore a newly-exposed beach.

But then the sea came back—engulfing the people, their houses, their effects, canoes, and animals, and flinging them into an inland lake.

Not all seaquakes result in disastrous tsunamis—one in the Aleutian Deep in 1929 nudged Hawaiian beaches with tidal waves only half a foot high. Of these the public rarely hears.

Nor are all destructive waves caused by earthquakes. Krakatoa, a volcanic island between Sumatra and Java, exploded in 1883 and sent 18 cubic miles of debris into the air, creating hundred-foot waves which swept onto nearby islands killing 36,000 persons and obliterating more than a thousand villages.

Earthquakes are rare in the Atlantic Ocean, and so are tsunamis, but one of each struck Lisbon, Portugal, in 1755 and pounded the coast with waves up to 50 feet high.

• In the next 10 years the Atlantic Ocean will be only 5 hours wide for the military man, and no man on earth no matter where he tries to hide out can get more than 24 hours away from you, whether he be friend or foe.
—Roy T Hurley

Actually, tsunamis are relatively uncommon even in the Pacific. Last century the average was one damaging tidal wave every 12 years Yet that — and the havoc wrought upon Hawaii in 1946—set seismologists to thinking How could this wholesale damage be avoided in the future?

When the 1946 seaquake occurred on the floor of the Aleutian Trench, it took five minutes to jiggle seismographs in Hawaii and nearly five hours for the deadly waves to strike the island shores

That would have been plenty of time for a warning Should distress alerts be transmitted after each such undersea earthquake?

Hardly. If Pacific residents were alerted every time a submarine earthquake rocked the Aleutian or Tuscarora or any other deep they would too often move out of danger needlessly, for very few undersea quakes stir up destructive tsunamis.

But thanks to researches like t' of the Hawaiian Volcano (' tory, special seismographic

systems have been set up, and are being helped by radio networks of the Civil Aeronautics Administration, U. S. Coast and Geodetic Survey, and the military services.

Today when an earthquake jars one of the Pacific deeps, shock waves are transmitted through the earth's crust in a matter of minutes to seismographs at widely scattered points from Alaska to Japan to Arizona. From these locations, the site of the quake is plotted, and should scientists on duty think the quake might have started a damaging tsunami en route toward coastal settlements, the warning is given.

That happened in Hawaii on election day, 1952. Warnings were posted and shoreline residents evacuated. The resulting tsunami, although not a comparatively severe one, caused tens of thousands of dollars in damage. The casualties? Six cows.

Electric Dental Drill May Reduce Pain

A dental drill with a built-in, drugless pain preventer has been demonstrated before the Chicago Dental Society.

The drill is hooked up to an electrical source and emits a weak direct current as it is applied to the teeth.

Known as "electro-anesthesia," the device is based on the long-known principle that an electrical current will desensitize tissue and raise the tolerance to pain

While the current goes through the patient's body, it is too weak for him to feel it.

In order to complete the electrical circuit, the patient holds the negative pole in his hand.

Reporting on the "hot" drill, Dr. Isamu Tashiro of Chicago, represented the inventor, Dr. Kensaku Suzuki of Tokyo Medical and Dental University.

Doctor Suzuki, he said, has found that 91 percent of patients do not feel the drill under this method.

The instrument has been tried at the University of Illinois dental school with "varying" results, a member of the faculty said.

Dual-Powered Locomotives

The first dual-powered American passenger locomotive equipped with electronic tubes for converting A C. electric power to D C. power has been delivered to the New York, New Haven and Hartford Railroad, it was announced by the General Electric Co.

G. W. Wilson, general manager of G.E.'s locomotive and car equipment department, said his company is building ten of these high-speed passenger locomotives for operation over New Haven's electrified lines between New York City and New Haven

On this run, the new rectifier locomotives must operate on both A.C. and D.C.

the BOOM in bank holdups

by George Cruikshank and Dan Cordtz

Condensed from The Wall Street Journal

THE Santa Clara branch of the First National Bank of San Jose, Calif., which opened on March 1 already has lost $10,000 in one brief transaction with a young man carrying a .38 revolver.

Manager Everett Clark was talking on the phone at noon on Monday, May 2, when the bandit entered "I guess I didn't hang up fast enough to suit him," says Mr. Clark. "He tore the phone from my hand and slammed it to the floor." He then scooped up the money and escaped.

The Santa Clara bank is among the recent victims of an upsurge in bank banditry. Banks are being held up with an efficiency and regularity reminiscent of the days of John Dillinger and Pretty Boy Floyd in the 1930's.

New York City, the nation's banking capital, has been particularly hard-hit. In an 11-day period in April, five banks in the New York area were robbed; in one case, three men lifted a record $305,000 in cash from a Chase Manhattan Bank branch.

Around the nation, banks are being robbed at a "feverish pace," according to FBI Chief J. Edgar Hoover. In 1954, there were 517 violations of the federal law covering bank robbery, burglary and larceny, more than double the 226 cases in as recent a year as 1950.

The FBI recently launched a cross-country drive to brief bankers on this topic: What to do about holdups

Although most banks are insured, they have plenty of reason to fret about the upswing in holdups. For one thing, their insurance rates are based partly on their experience; a rise in losses likely will mean higher rates. A successful holdup may lead to additional attempts. And the public often heaps ridicule on the victimized bank When New York officials, after the Chase Manhattan holdup launched a program to tighten security, cynics promptly dubl "Operation Barn Door."

Most banks, sometimes prodding of law-enf

The Wall Street Journal (May 4, '55), 44 Broad St., New York, N. Y.

cies, are taking a hard look at their anti-bandit setups. Some are hiring new guards, buying new equipment, adopting tricky alarm systems—and even considering monitoring their lobbies with television cameras.

Manufacturers Trust Co. of New York City has ordered its 111 branches to keep vault cash to an "absolute minimum." When a branch accumulates a certain quota — the amount is a closely-guarded secret— it must ship the money to the main office or to the Federal Reserve Bank. And the embarrassed Chase Manhattan now has spotted armed guards in all its 94 branches; many of its branches previously had no guards.

For the past several months, a New York City policeman has been checking in at each of the big downtown banks one hour before it opens and staying around for an hour after it closes. The before-opening police guard is aimed at "early-bird" bandits — sometimes called "morning glories."

The three men who held up the Chase branch were early-bird operators They captured the chief clerk while he was on his way to the bank in the morning, used his key to enter the bank and in eight minutes made off with their record haul. A similar early-morning foray by a single bandit at a Long Island bank in 1953 netted $190,000, but that bandit, and an inside accomplice, were caught and convicted.

Early-bird bandits got $135,000 from a Washington state bank a few months ago. An early riser not long ago scooped up $20,875 from a Kansas bank. And in New York City's neighboring Westchester County another early arrival made off with $97,564.

Attacks against banks by outsiders fall into three classes: robbery, burglary and larceny. In a robbery, one or more persons takes money from banks or bank employees by force or with a threat of force. A burglary occurs when a bandit blasts a hole through a bank wall or otherwise breaks into an unattended bank, usually at night. It's larceny when a light-fingered thief picks up a pile of bills when a teller's back is turned.

Robbery is the big problem. Burglaries have diminished with the introduction of modern vaults and alarm systems. And the amount of cash involved in larceny usually is small.

• • •

Even more worried than bankers about the upturn in holdups are the insurance companies who cover the banks against loss—either from bandits or from tellers who might get sticky fingers. They sell what's known as a banker's blanket bond, issued in various sizes ranging up to $10 million.

Insurance men say no general upward revision of rates is in the offing. But big holdup victims can count on higher charges. That's because a bank's premiums are adjusted to reflect its own experience.

"A bank can get as much as a 40-percent discount for a perfect experience rating," explains R. T. Wood, manager of American Surety Com-

pany's bank division. "As losses increase, discounts drop."

"We're in a crime trend; there's no doubt about it," declares Fred Moran, assistant secretary of Federal Insurance Co. of New York. Mr. Moran claims bank robberies run in cycles. "We had a terrific surge of them a few years ago; then they died down to practically nothing."

The American Bankers Association has drafted a lengthy list of do's and don't's to foil bank bandits. Among the major suggestions: The employee who has the key to the front door should keep it a secret, for his own good, as well as the bank's. Employees also should keep quiet about the cash a careless bandit overlooked; reports that $50,000 was missed might invite another visit.

The A.B.A. also suggests a bank officer should phone the bank daily before opening time to get an all-clear or a danger signal—in code—from employees An employee should be stationed near the bank to see whether the officer opening the front door is accompanied by a gun-toting bandit.

Although the Association won't endorse any brands of protective equipment, it approves certain general types: Alarms should be silent; a clanging bell may cause a bandit to panic and begin shooting up the place. The A.B.A. also favors a "money trap" for a teller's drawer. Two or three bills are placed in a spring clip in the drawer; when the bills are withdrawn, an alarm is set off automatically.

Some banks have placed tear-gas guns at the front of tellers' compartments. Many banks object to tear gas, however, since accidental discharges have caused stampedes toward exits and loss of business; banks sometimes had to close down for a day to clear out the fumes.

Other devices include a concealed camera that photographs a bandit, and microfilming equipment to take pictures of the banks' cash. An Eastman Kodak machine can microfilm money at the rate of 500 bills a minute.

Among the best protection, however, is a group of alert, courageous employees, most bankers agree. A special A.B A. survey indicates 47 bank holdups were frustrated last year. Frequest causes: Tellers quickly drop behind counters, setting off alarms; guards overpowered the bandits before they could get away.

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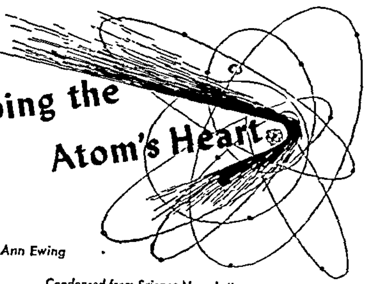
Despite the current rise in bank banditry, holdup men still aren't quite as busy as they once were. James E Baum, head of the A.B.A.'s insurance and protective department, says the record was set in 1932, when 554 banks were held up; that compares with last year's 305.

Although the Chase Manhattan robbery is the biggest cash haul ever, it's small in comparison with the total take in a Lincoln, Neb., robbery back in 1930. Armed bandits grabbed $2,244,000 in [illegible] plus $24,000 in cash—from [illegible] coln National Bank, [illegible] bank out of business and [illegible] record that still stands.



Probing the Atom's Heart

by Ann Ewing

Condensed from Science News Letter

MAN has exploded atomic and hydrogen bombs: powerful nuclear reactions on earth. Although the tremendous energies inside the atom have been tapped, what binds together the contents of atomic hearts is a mystery still unsolved.

Twenty-one particles in and around the nucleus are now generally recognized by physicists. Most of them exist only for fleeting bits of seconds. Some of them have strange names such as K pi-two or lambda zero. Others have long been known:

- **Neutrons**, trigger for atomic bombs and nuclear chain reactions;
- **Protons**, positively charged hearts of common hydrogen, and
- **Electrons**, light-weight particles with a negative charge, whose mass movement in conductors produces electric currents.

Combined in various ways, these three basic particles once gave a very satisfactory picture of the 92 kinds of atoms then known.

Over 50 years ago, the late Prof. Albert Einstein suggested that mass and energy were basically the same thing. Over 15 years ago, scientists began to suspect that the energy in the mass of an atomic nucleus could be tapped on a large scale. But the glue that holds the strange particles inside the nucleus is still not known, even though the blinding flash of nuclear explosions has many times spelled out the equivalence of mass and energy.

Most of the mass of the atom is in its nucleus. Each atom of an element consists of a mist of one or more electrons swirling around the nucleus, millions upon millions of times every second. Although an atom is mostly empty space, the whirling electrons form a shield, keeping electrically-charged particles out of the space

Science News Letter, 1719 N St., N.W., Washington 6, D. C.

within as effectively as though they were everywhere at once.

This smoke of electrons determines the element's chemical properties, from hydrogen with 1 electron to mendelevium, No. 101, with 101 electrons outside its core. Atoms are so minute that about 200 million of them could be placed next to each other within an inch.

One atom, magnified 3 billion times, would give a globe about 2 feet in diameter. Yet the nucleus is so much smaller than the atom itself that, magnified the same amount, it would be barely visible

Only particles smaller than atoms can get inside an atom. They must have great speed to penetrate the screen thrown up by the electrons and, even then, they often go right through without hitting anything.

When these fragments of atoms do collide with the nucleus, however, sometimes they ricochet; sometimes other particles are thrown out of the nucleus. The resulting scattering, its pattern and the energies of the emerging particles, give clues to the structure of the nucleus

But they also give one of the biggest headaches—the time lag. Such events unaccountably take about 10 billion times longer than would be expected. Scientists have discovered this even though these reaction times range from a millionth to a billionth of a second or less. But why they take so long to react is not known

Explaining not only the timing but the multitude of particles that come whizzing out of the nucleus under different circumstances are two of the puzzles physicists are trying to solve today. So far, each step forward in probing the nucleus has led to more questions than it answers.

And if and when scientists do understand what holds an atom together, the information may or may not be "useful" in "practical" ways.

• The scientist, like all explorers, is happier in traveling than in arriving At the present moment of time he is fortunate in living at one of the climacteric phases of science. A whole new world has just been disclosed, offering unlimited opportunities of discovery —J. A V. Butler

Since 1932, when the neutron was discovered, a nucleus has been thought to be the atomic heart, made of protons and neutrons bound together in some still unexplained manner.

Now physicists wonder whether an "onion" or a "water drop" is a more accurate picture of an atomic heart. For when the core has only a small number of particles, as in oxygen, it reacts to bombarding particles as if it consisted of easily peeled layers But when the nucleus has many particles crowded together, as in radium, the picture is more like that of a vibrating water drop which, after swallowing several bombarding particles, suddenly splits into two.

Or, as one scientist explained, the nucleus seems to have a schizoid personality At low energies, its inhabitants all seem to follow one set of rules, but at high energies, they behave very differently.

Physicists have found that a bewildering number of particles can driven out of the nucleus by

particles, slow ones or fast ones: even by the energy of light itself. From this crowd, some familiar faces are emerging. The particles seem to fall into certain groups having somewhat similar properties.

Of these, the first to be discovered were the light-weight mesons. Mesons are unstable particles, lasting only a few millionths of a second, with a mass between that of the electron and proton. Five examples of this type are now known: three pi mesons, with positive, negative and neutral charge, and two mu mesons, one positively and one negatively charged.

A group of heavier mesons, also with masses between that of electrons and protons, are known as K mesons. These include theta zero, K mu-two and Ke, two tau particles, one with a positive and one with a negative charge, and K pi-two, either positively or negatively charged

The third set consists of those with higher masses than protons. Called hyperons, they are lambda zero, negative xi, and two sigma's, positively and negatively charged.

Completing the list of 21 accepted particles are the positron (a positively charged electron), and the neutrino, a tiny particle having little or no mass and no electric charge. The neutrino has never been seen, but its existence, nevertheless, is believed real. A neutrino might well penetrate the entire mass of the sun without reacting.

To analyze atomic hearts and learn about the strange particles that come zooming out of them, scientists use many tools to measure lifetimes, energies and masses.

One of the most promising recently developed devices is called a bubble chamber. Subatomic particles plunging through a superheated solution, kept under high pressure to delay its boiling, produce a train of bubbles. In this manner, the bubble chamber is similar in operation to the cloud chamber, which physicists have been using for many years to track the otherwise invisible particles. A cloud chamber is filled with supersaturated water vapor in which the particles cause fog trails to form.

Great advantage of the bubble chamber is that about 20 times as many particles can be caught in it as in a conventional cloud chamber of the same size. Different liquids, such as liquid hydrogen, can also be used.

Another important, recent development is the polarized proton beam. In it, the protons have spins all in the same direction. The achievement is equivalent to the polarization of light, in which the light's vibrations are all in one direction, rather than randomly distributed.

Every atomic nucleus, as well as individual particles, spins on its axis. In an unpolarized proton beam, the axes point every which way. To polarize the beam, protons are hurled at a target of hydrogen, beryllium or carbon. By choosing only those protons that ricochet at a rather small angle, the particles with axes pointed in the same direction are selected.

The protons lose energy when they smash into the target, but if they

have high enough energies, the bombardment and selection process can be repeated to get a purer polarized beam. So far, scientists have managed to analyze the particles produced after a beam has gone through three targets, known to the scientists as triple scattering. They have also learned to tell whether the axis is pointed "up" or "down."

Although man is reaching higher and higher energies in atom smashers such as needed to polarize protons, even the particles hurled by the most powerful machines are only now beginning to rival the energies of the weakest cosmic "rays" (themselves particles) that bombard the earth from outer space.

Photographs of nuclear collisions in cloud chambers located high in the mountains or installed in balloons and airplanes catch tracks of some of these. Emulsions such as used in ordinary photographic film are also a valuable tool.

Fake Calls Scare Dive-Bombing Sea Gulls

The scientific conqueror of the starling has moved in on the sea gull. Its days of dropping clams on boardwalk strollers and interfering with landing airliners may be numbered

Hubert Frings and his associates at Pennsylvania State University disclosed that gulls give off alarm calls which, when recorded and broadcast by loudspeakers, can cause any gulls in the vicinity to make themselves scarce

Frings had succeeded in dispers- [illegible]

when he started catching them, are not distressed by captivity

Gulls had him licked—until he noticed that other gulls, spotting a captive fellow-gull, give off with a sound that sounds like "cut-cut-cut," with the accent on the first note.

This, Frings and his co-workers reasoned, was an alarm call—as though the circling gulls were shouting to one another "Look out! There's a guy down there catching sea gulls."

So he recorded the sound and broadcast it over a fish dump near Salsbury Cove, Me, where gulls have fed for years. Some 300 gulls were around Their first reaction was to come closer Their second was to circle away and disappear. One broadcast would keep them away for as long as 3½ hours When they returned, he gave them another loudspeaker blast and away they went again.

He tried it out at a seashore sardine-packing factory and a fish-meal plant, and it worked just as well

In the course of his studies, he found the gulls have another call—a "food-finding call." By recording and ' . casting that call, he could attract a of gulls in a few minutes But he send the flock flying just as qu' broadcasting the alarm.

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FLUORIDE IN SALT FOR PREVENTING DECAY

Fluoride in table salt may serve to reduce tooth decay as much as does fluoride in drinking water, in the belief of Dr. James H. Shaw, assistant professor of dental medicine, in the Harvard School of Dental Medicine, Cambridge, Mass.

Analyzing the enamel and tooth tissue of teeth extracted in a Delhi, India, clinic, he found the average fluoride content to be at levels sufficient to retard decay.

Use of a mixture of salts prepared by evaporation of sea water, Dr. Shaw told the American Societies for Experimental Biology, may be the answer to the low susceptibility of Delhi residents to tooth decay. He estimated the amount of decay to be one-third to one-fourth that of Americans.

"The Indian Sea salt, which is prepared from sea water and is not further processed," Dr. Shaw said, "evidently supplies as much fluoride as would be supplied by drinking-water containing somewhere between 2.5 and 3.5 parts of fluoride per million parts of water.

"This is one of the first major evidences we have had that fluoride-containing substances other than water can aid in the prevention of dental caries."

THE THIRD SEX

There exists a third sex, a so-called "neutral gender" which encompasses roughly all persons who have reached an average age of 60, say Drs. William H. Masters and John W. Ballew, Washington University, St. Louis.

They point out in *Geriatrics* that well-controlled sex hormone replacement will provide significant physical and psychic stimulation in these persons but it does not increase longevity. There is marked resurgence of physical strength and mental awareness in men treated with testosterone and in women treated with estrogen.

KIDNEY DISEASE HIT BY HORMONES

Deaths from nephrosis, a severe kidney disease, have been reduced by 80 percent using ACTH and cortisone, according to Dr. Kurt Lange of New York Medical College and Flower-Fifth Avenue Hospital.

Where at one time children and adults were forced to undergo hospitalization for many months, he points out in *Pediatrics*, they now are hospitalized only briefly in the begin-

SS

CINE

by Arthur J. Snider

ning and then treated as outpatients.

In the last five years, only 1 of 29 cases treated died, Dr. Lange said. The expected mortality without use of hormones would have been 6.

STRICT BED-REST EDICT ON TB RELAXED

Strict bed rest is no longer considered as necessary for the control of tuberculosis as it was in the past, says Dr. Sidney H. Dressler of Denver, although many authorities still believe an initial short period of bed rest is important.

Drug treatment, meanwhile, must be given for at least 18 months. Once the toxic symptoms have disappeared, the drugs can be given on an ambulatory basis, Dr. Dressler said.

PILLS AS PROPHYLAXIS AGAINST VIRUS DISEASES

The better hope of coping with man's viral diseases lies in drug therapy rather than vaccines, in the belief of Dr. Thomas Francis, Jr.

The famed author of the Francis report on the Salk vaccine, and the developer of the influenza vaccine himself, contends that more and more diseases will be found to have viral origin.

To develop, say, 50 different vaccines for 50 different diseases would not only be impractical, he adds, but offer a complex immunological task.

Thus, he told the Illinois State Medical Society, emphasis should be placed on chemotherapy.

He pointed up the possibility that a drug found effective against one virus disease might have a carry-over effect against others.

Such drugs, once the toxicity is removed, could be taken routinely as a prophylaxis, he speculated. While he did not spell out the idea, it could conceivably take the form of a salt to be placed in the shaker and eaten with meals, a pill to be dropped in water or a vitamin-type capsule.

Doctor Francis conceded the fact that thus far science has not had too much luck with drugs against viral diseases. "But the prospect is not the hopeless one so commonly expressed," he said.

He told of "highly significant results" at the University of Michigan laboratories in protecting monkeys against virus onslaught by means of experimental drugs.

One of these, for example, sodium fluoroacetate, has been found to retard the growth of flu virus in

Another, known as MS-8450, given to a group of monkeys with polio virus, resulted in

third as many cases of polio as compared with a similar group.

It is conceivable, Dr. Francis added, that the drugs may fortify the walls around the individual cells so that virus cannot invade; or, once the virus is in the cell, prevent it from escaping.

• • •

That anti-virus drugs may not be too far off also is the belief of Dr. Igor Tamm, Rockefeller Institute for Medical Research.

He told the Society of American Bacteriologists of test-tube experiments in which the influenza virus was completely stopped from multiplying by a drug made from the chemical, benzimidazole.

GOOD BREAKFASTS BRING GOOD TEMPERS

It's not getting out on the wrong side of bed that makes the business girl cross; it's coming to work without breakfast. Lack of breakfast not only affects the disposition, reports the family economics bureau of the

Northwestern Life Insurance Co., it is also bad for health and mental alertness. A survey of 1,600 Minneapolis white-collar workers showed 45 percent of the women under age 25 ate little or nothing before going to work. Only 23 percent ate a "good" breakfast, including juice, milk or egg, and cereal.

SPONGE-RUBBER BOOT FOR VARICOSE VEINS

A zippered sponge-rubber boot to relieve severe varicose veins of the lower leg has been developed by Drs. Walter G. Gasner of Mt. Vernon, N. Y., and Maurice J. Costello, New York City.

The action of the leg muscles against the sponge-rubber causes a "pump-like" action while walking, the physicians said in *The Journal of the American Medical Association.*

RADIOACTIVE B-12 TIPOFF ON CANCER

Since cancer of the stomach occurs 100 times more frequently in persons with pernicious anemia than in the average population, University of Minnesota surgeons use radioactive vitamin B-12 to detect whether a person is anemic.

Those persons, having this greater susceptibility to cancer, are encouraged to have frequent checkups for cancer, perhaps four a year.

The radioactive substance is given in a glass of water. As a treatment for anemia, the vitamin is injected into the bloodstream.

THE PATTERN OF CANCER RESEARCH

It has now been ten years since the new era of cancer research began. Here is the American Cancer Society's evaluation of the promising leads that have unfolded:

Radioactive Isotopes — Radioiodine has shown encouraging results in thyroid cancer. Scientists have molded isotopes of metals into nylon threads and sewn them into tumors.

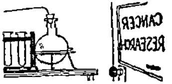
Others have found that tiny radioactive-gold particles suspended in a fluid could be injected into the body and would help women with advanced ovarian cancer ward off death for a time. As a research tool, isotopes have permitted the tracing of the puzzling pattern of genetics so that now it can be said that cancer is not handed down as a legacy from one generation to the next.

Hormones—No lasting cures but astounding changes have happened in advanced cancer patients who have been treated with hormones. In women with cancer of the breast that has spread to other organs, hormones have given them a new lease on life In men, cancer of the prostate which strikes frequently among those of older age, was slowed by estrogens, the female sex hormones. Cortisone, a hormone derived from the adrenal glands, brings repeated improvements in children with acute leukemia.

Chemotherapy—Victims of Hodgkin's Disease—a form of cancer attacking the lymph glands and spleen —have been kept living far beyond their previously expected span through use of nitrogen mustard, a wartime poison gas tamed for use at the bedside. Polycythemia vera, a blood cancer in which the red cells reproduce madly, is often controlled by relatives of nitrogen mustard.

From the vitamin field has come the development of anti-folic acids, aminopterin and amethopterin, which are enough like folic acids to slip into the unwary cancer cells and sabotage vital operations. More recently, 6-mercaptopurine and azaserine have emerged for clinical use.

Cell Mapping — Micro-chemistry has been improved to permit analysis of fantastically small amounts of substances. The electron microscope that sketches pictures on a fluorescent screen with streams of electrons guided through magnetic lenses has permitted man to look at viruses, the smallest of objects that possess life processes. This permits an ultimate decision as to whether cancer might be virus-caused.



Antibodies — When pollen enters the body, the tissues react by producing antibodies, substances that will neutralize the intruder. Why not find antibodies that will work against cancer? In the last decade, the American Cancer Society says, extracts of human cancer have been injected into animals Fluids withdrawn from the animals were injected into the cancer patient. In some instances there seems to be promise. The experiments are continuing.

Surgery—Wider extension of surgery is being done with whole stomachs being removed and occasionally replaced with one contrived from a portion of the large intestines Salvage of hitherto hopelessly advanced uterine cancer is being undert by removing large amounts of from the abdominal cavity. C are removing adrenal gl

even the pituitary gland to cut off the body's flow of hormones in advanced breast cancer.

Radiation — The novel rotation method of treatment has come into use along with multimillion-volt machines to strike cancer deep within the body, in vital spots beyond the reach of surgeons.

Tests — The Papanicolaou smear method of finding uterine cancers in the earliest "silent" stages by examining cells shed off and collected from body fluids has found wide acceptance.

BABY BOOM CONTINUES

The baby boom which started at the close of World War II continues unabated, according to statisticians of the Metropolitan Life Insurance Co. From 1946 through 1954, the number of births in the U.S. averaged more than 3¼ million annually or 1⅗ times the number in 1933.

The important factors in the upsurge in births have been the marked rise in the proportion of married women and the almost uninterrupted rise in the fertility rate from its low level in the 1930's.

RADIATION CURES THOSE "BIRTH MARKS"

Birthmarks, technically known as hemangiomas, can almost always be cured by skilled radiation therapy, according to Dr. George E. Pfahler of the University of Pennsylvania. The exception is the large "port wine" birthmarks.

Speaking to the Inter-American Congress of Radiology, he said birthmarks should be treated as early in life as possible, preferably in the first few months.

SUN IS A STAR OF DEATH FOR FAMILY

A family in southern Illinois must stay out of the sunshine if it wants to survive. Because of a hereditary condition, members have no inborn protection against the effects of ultraviolet rays.

The skin tends to develop freckles at an early age. This is followed by dark red wart-like spots that eventually become cancerous under daily sunlight exposure. The skin cancer spreads and causes death early in life.

Doctor Otto C. Stegmaier of Moline, Ill., pointed out to the Illinois State Medical Society the family members avoid the sun entirely by working in the mines during the day and conducting business and social affairs after sundown.

Normal individuals also can be sensitized to sunlight. Certain chemicals applied to the skin, for example, sensitize it so that highly-colored spots will appear on exposure to sunshine.

Some drugs taken internally, such as sulfas and barbiturates, may have a similar effect in some people. Blisters and pigmentation reactions frequently result.

PHOBIAS

A Quiz

by William P. Schenk

WHEN A PERSON'S FEARS are magnified

from Greek) identifying them with the object or situation against which the unfortunate victim's fears are directed How many of the 15 phobias listed here can you identify?

1. Monophobia is (a) the fear of carbon-monoxide poisoning; (b) the fear of mountains, (c) the fear of being alone.

2. Topophobia is (a) the fear of situations, *i e*, stagefright; (b) the fear of wide-open spaces; (c) the fear of being at the top of high ladders, poles, buildings, and other high-up places.

3. Potamophobia is (a) the fear of sterility; (b) the fear of running water; (c) the fear of Indians.

4. Dromophobia is (a) the fear of crossing the street; (b) the fear of camels; (c) the fear of doorways and gates.

5. Astrophobia is (a) the fear of the stars; (b) the fear of prophetic omens; (c) the fear of storms.

6. Batophobia is (a) the fear of suffocation; (b) the fear of bats; (c) the fear of falling objects.

7.

8. *Anthropophobia* is (a) *the fear* of people; (b) the fear of insects and spiders; (c) the fear of anthrax

9. Claustrophobia is (a) the fear of animals' claws, (b) the fear of loss of blood; (c) the fear of enclosed spaces

10. *Mysophobia* is (a) *the fear of* the dark; (b) the fear of dirt and contamination, (c) the fear of being murdered

11. Acrophobia is (a) the fear of high places; (b) the fear of the dead, (c) the fear of medicine.

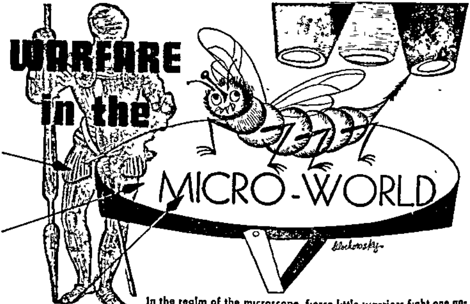
12. Pyrophobia is (a) the fear of pyramids, (b) the fear of fire; (c) the fear of reptiles

13. Agoraphobia is (a) the fear of creeping plants and vines; (b) the fear of open spaces; (c) the fear of furry objects.

14. Aichmophobia is (a) the fear of sharp and pointed objects; (b) fear of pain; (c) the fear of

15. Pantophobia is (a) *suffocation*; (b) *the fear of* (c) the fear of panthers

(Answers on Page 84)



In the realm of the microscope, fierce little warriors fight one another with weapons which pre-date those devised by man

by Eric V. Grave — *Condensed from Natural History*

WE HUMANS are too much impressed with our own resourcefulness. It is true that our ancestors probably could not have survived in the world of fang and claw without well-developed brains for devising substitute weapons, but we often overlook the fact that their spears, knives, and poison arrows were preceded by similar devices used by other creatures since the dawn of life.

A microscope helps to deflate the ego, since many of the more ingenious of these weapons are too small to be seen with the naked eye. Some of them would greatly tax man's inventiveness if he were to try to copy them even with means at hand today.

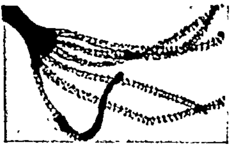
For instance, the deceptively sluggish Hydra (a tiny polyp, named after the nine-headed monster slain by Hercules)—which takes hours to change its position only a few inches—kills with lazy efficiency by lashing out at its victims with poisonous whiplike threads.

It remains almost stationary on a rock or other hard surface, with tentacles spread, moving them spasmodically now and then. The tentacles are studded with bodies called nettling capsules, comparable to tiny guns. Each of these contains a poison and a hollow, barbed thread coiled like a hairspring. When a potential victim, perhaps a water flea, brushes against Hydra's tentacles,

Natural History (Apr. '55), 79th St. at Central Park W., New York 34, N. Y.

some of the capsules explode and eject their threads. These strike the prey and paralyze it with poison exuding from their tips. Hydra is then ready for a leisurely meal.

Hydra's guns are more efficient than man's. They will not fire accidentally, but only when organisms suitable for food touch the tentacles. Amazingly, they will not discharge when touched with a leaf or a stone, or even when irritated by a parasitic polyp-louse crawling along their surfaces. After use, nature provides Hydra with new guns in only a few hours.



HYDRA waits for a victim to brush up against its tentacles, then paralyzes it with poisonous threads shot from its nettling capsules.

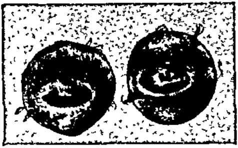
There is an even smaller warrior, a one-celled animal called *Didinium nasutum*, which overcomes its neighbors in a manner having almost no parallel among higher animals. Didinium feeds mainly on the paramecium, or slipper animalcule, which is faster and larger. Both are blind, so it is pure chance that they bump into each other.

But, when they do, Didinium clamps its snout tight against paramecium and, snake-like, simply widens its mouth little by little and engulfs its victim whole Ultimately, it swells to two or three times its original size.

Paramecium has almost no defense against Didinium, but it does have a battery of curious mechanisms that have been labeled defensive by some observers. These are the trichocysts, a multitude of tiny oblong sacs, each of which, in the resting stage, is only .00016 of an inch long. When paramecium is attacked, these shoot out in all directions to screen the animal with a forest of outthrust threads. Just how they stretch out so quickly is not understood.

The larvae of some European moths have microscopic weapons capable of inflicting injury even upon man. These are the processionary caterpillars, so named because of their habit of moving about at night in meandering caterpillar-armies up to six feet long. This habit makes them extremely vulnerable to birds, so the poisonous hairs that they have evolved should be classed as defensive weapons. The hairs are so brittle that they are sometimes broken off and carried by the wind into the eyes and mouths of unsuspecting hikers, causing acute inflammation Forests in some parts of Europe have been closed to the public when dangerously infested

Much of the fighting in the microworld is chemical warfare, the daggers and spears being devices for injecting poisons. Superior users of this technique are some of the [illegible]
tary wasps. They have defined
the purpose of furnishing [illegible]
fresh" food for their larvae
Their poison is such that [illegible]



TWO DIDINIA, enlarged 300 times. These pond-dwellers swallow their prey whole.

caterpillars, or flies into which they inject it are not killed but indefinitely anesthetized, waiting to become banquets for future wasp families.

A dramatic instance of this natural anesthesia is the performance of the wasp *Cerceris tuberculata* Klg., which chases exclusively a luckless weevil called *Cleonus opthalmicus*. When Cerceris locates Cleonus, she grabs him and during a brief struggle plunges her stinger into a nerve center in his chest. Cleonus drops thunderstruck; the wasp lifts him and carries him off to her nest. She repeats such conquests until, several weevils later, she is ready to deposit her eggs and seal the nest, never again to fret about fresh food.

Another wasp, *Eumenes pomiformis* Fbr., catches caterpillars for her offspring, but apparently is unable to paralyze them completely, for, after anesthesis, they still move when touched. Eumenes makes up for this imperfection by suspending her eggs from threads attached to the ceiling of the nest. When the larvae hatch and begin to feed, they can escape injury by climbing up the threads when the victim begins to struggle.

The venom that accompanies a wasp's sting is a mixture of two chemicals produced in separate glands. One gland secretes acid into a large poison sac; the other secretes an alkaline fluid into the base of the sting. The fluids are mixed when the wasp uses her sting, and the mixture is more effective than either would be alone. Two fingerlike sense organs enable the wasp to pick the best spot for injection; strong muscles pump in the poison, and two more glands are believed to lubricate the various parts involved. All in all, a very complex machine.

A worker bee's stinging apparatus is much the same except that it is ordinarily used only once, while the wasp's may be used many times. The bee's sting is barbed, and she has great difficulty extracting it after she has thrust it into an intruder. So she usually suffers fatal injuries—a miniature kamikaze. The reason she almost always dies is that her complete stinging apparatus, with poison sac attached, is usually wrenched from her body and left sticking in the wound. The detached muscles keep on working and drive the sting in deeper and deeper while more and more poison is pumped in.

Thus the bee is sacrificed, but she does a better job than she could have by simply puncturing the skin and rapidly flying away.

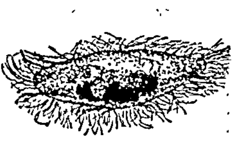
It is impossible when studying these tiny weapons to keep from comparing them with familiar instruments in the doctor's office, and the similarity is almost uncanny in the case of the stinging nettle—a troublesome plant.

The stinging nettle is equipped with many thousands of stiff hairs constructed like tiny syringes. A vesicle at the base of each hair contains a poisonous fluid, mainly formic acid, and the hair itself is actually a long, hollow, very brittle needle, closed at the point by a tiny knob. At the slightest touch the knob breaks off, the hair penetrates the skin, and the resultant pressure against its base forces toxic fluid into the wound.

But the micro-weapons with which we humans are most acutely familiar are the tubelike mouth parts of blood-sucking parasites, such as mosquitoes, bedbugs, fleas, and lice. Fortunately, we still have the upper hand

One of their weaknesses is that while thrusting their needles, stylets or mandibles into our skin, they must simultaneously inject saliva into the wound to keep the blood from clotting. This creates a momentary irritation which warns us that we are being attacked, and spurs us to counter-attack.

To a bedbug this is a serious problem, because he needs five to ten minutes to get a satisfying meal. Furthermore, he needs at least one hearty meal between each molting in order to develop into a healthy, robust adult It's a dangerous life



PARAMECIUM'S thread-like trichocysts suddenly take form as a protective screen, but do not faze Didinium (on opposite page).

If you are inclined to imaginative thinking, a few hours of peering through a microscope at the fierce little world of the bedbug and his confreres will make you eternally grateful to Providence for giving us an advantage in size as well as an advantage in intellect over these diminutive assassins For, with their knives, stilettos, needles, tentacles, poisons, and anesthetics, they might have carved quite a different niche in life if nature had made them larger.

Predict Electric Auto's Return

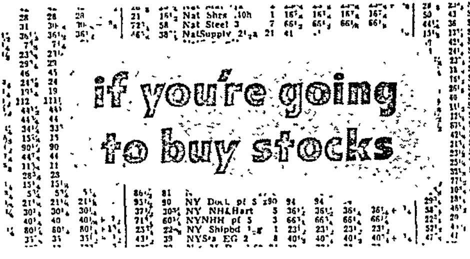
By the year 2000, automobiles may operate on electricity from central atom-power stations, and acres of land may be covered with mirrors to gather energy from the sun, the dean of the University of Michigan College of Engineering observed recently.

Dean George Granger Brown predicted that greater use will be made of electricity from central atomic plants in the powering of cars in the future

"The trolley car or trackless trolley may yet return to our highways," Dean Brown said, "and private cars on the main roads might take their power fr an overhead line supplied by a ce station"

While traveling side-roads, t might operate on storage-batte the speaker noted.

if you're going to buy stocks



by Mark Steele

Condensed from This Week Magazine

THINKING of getting into the stock market? Seven million Americans are in it already, and thousands more are joining them every month. If you do go into the market, you're bound to hear a number of pat expressions that are part of the mythology of Wall Street. Some are partially true, the others plain untrue. They all can be dangerous to you if you pay too much attention to them. Herewith are nine of these "facts," along with the explanation of each as pieced together from talks with market veterans:

Myth 1. *You cannot lose a lot of money by investing in penny stocks.*

You can't lose more than you put into them, but you can lose that without too much trouble. A stock tha sells for 15 cents a share sounds smal enough. It means $150, though when you buy 1,000 shares. Yo find penny stocks usually in oil, gol and now uranium, and trying t locate such products is very exper sive and uncertain. Therefore th companies that offer you penn stocks generally have little mor than hope to give you for you money.

Myth 2. *Buy 'em and forget 'en*

That would have been sound ac vice if you had bought Genera Motors back in 1923. A thousan dollars invested then would b worth $24,000 today, plus dividenc through the years amounting to ar other $14,500. But suppose you ha gone into Stutz Bearcat, or Assoc ated Gas & Electric or Kolster R

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dio. That thousand would have been written off a long time ago. There is no need to get an ulcer every time your stock goes down an eighth of a point. But you wouldn't run off to Florida if you'd just bought a candy store, so why bury your head when you buy a piece of United States Steel or A. T. & T.?

Myth 3. *You can't lose taking profits.* Maybe not, but are you sure you're getting all you deserve from a stock? For example, are you missing out on a dividend? It may be worth your while to keep your stock at least six months before selling and benefit from the 25-percent maximum rate of the capital gains income tax. If you sell within six months, your profits will be taxed much more heavily. And if the company in which you're investing seems to have a promising future, why shouldn't its stock continue to rise? Remember, you pay a commission every time you buy or sell, so maybe you should resist that natural impulse to take the first small profit you can realize.

Myth 4. *Take your losses quickly.* This may make sense for the speculator. It's not too wise for him to stay with a stock that's dropping when he can put the same money into something that may have a better chance. However, if you're in the market as a long-range investor, a dip in a stock—unless the company seems headed for bankruptcy—should be waited out. On a long-time basis U. S industry rises at the rate of 3 percent a year.

Myth 5. *The previous price means nothing.* It's true that the day-to-day fluctuations in the market value of a stock have little meaning for you if you are investing for the long pull. Such factors as the earnings of the company, its dividend history and rate, its management and the prospects for its future are the things to watch! A stock that is selling today at 100, was 90 last week, 105 the week before, certainly promises to be more volatile than another that has stayed within a 2-point or 3-point range for the last six months.

Myth 6. *Watch the averages.* It's dangerous to take the averages too seriously. All they try to do is show the over-all movement of the market by sampling the stocks of a few companies. They are figured by adding the final selling price each day of a handful of stocks picked from more than 1,200 on the New York Stock Exchange While it's true that the market in general moves as a whole, the individual stocks *you* own may go up and down because of factors that have nothing to do with any others. The day last December that the Dow-Jones Average hit 400 for the first time, 229 stocks closed unchanged from the day before Two hundred and ninety went down, a few of them even reaching new lows for the year.

Myth 7. *Forget the market's*

Sure, the market's gener predictable, but its history that it follows certain

responds to business conditions. War news means a rise in "war babies"—aircrafts, tanks, precision instruments. Once a market trend is started, it tends to continue. When the market is going up, it brings on optimism that pushes it up even more; and when it's going down, the pessimism makes it move even faster. Studying the market's past can give you some idea of its future.

Myth 8. *The public is never right.* On this principle you would buy when others are selling, and sell when the rest are buying. But the important thing to keep in mind is that it's largely the opinion of the public about a stock that controls its movement. If a lot of people want to buy it, up it goes; if they want to get rid of it, it moves down.

Myth 9. *You've nothing to worry about with the S.E.C. in business.* This is probably the most dangerous myth of all. It's true that the Securities and Exchange Commission stops many of the abuses that brought on trouble in 1929, but it can't do more than it's supposed to. On page 1 of any prospectus you'll read: "These securities have not been approved or disapproved by the Securities and Exchange Commission nor has the Commission passed upon the accuracy or adequacy of this prospectus." This is a warning to do a lot more checking before you invest your savings.

Trace Recent Rock Pictures to Stone Age

Travelers in the Negev, Israel's southern desert, have noticed for some time curious decorative markings on rocks along their routes

Until recently the engravings — pictures and inscriptions—were generally believed to be the work of modern Bedouins, and some of them were But, alongside modern art work, scientists discovered inscriptions and pictures that artists of remote times had painstakingly chiseled.

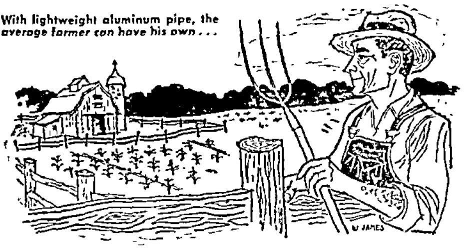
An account of a late survey of the rock engravings, or petroglyphs, by Dr. Emmanuel Anati, an archeologist with

seven styles of as many periods. A chronological framework for the three earliest, and scarce, styles cannot yet be determined But the most ancient picture found—of a man and horned animal engraved on the wall of a cafe in Wadi Hamilyeh — has been tentatively assigned to the Stone Age.

The next earlier engravings also are still undated. But they are considerably older than others of Hellenistic-Roman times that had been superimposed. In the earlier of the companion drawings, scenes, carved with life and movement, offer a contrast to the latter, which, dating from the 3d century B. C. to about the 3d century A.D., are described as "static repetitions."

—*Chicago Daily Tribune*

With lightweight aluminum pipe, the average farmer can have his own . . .



PUSHBUTTON RAIN

by Ross L. Holman

FOR MANY YEARS drought-stricken farmers have sought relief by praying for rain. Now they are beginning to answer their own prayers. With lightweight aluminum pipe the average farmer can now have his own rain if he wants it, when he wants it, and where he wants it

Of course, it will be easier for some landowners than others The most important thing is to have an accommodating creek, river, strong well, or other convenient water source. If it is a dependable supply he will just hook up a pump, some hundreds of feet of pipe, and put that water where it will do the most good He will no longer have to look anxiously toward the clouds and wishfully hope for the heavens to spill out their moisture.

One Tennessee farmer I know specializes on hybrid seed corn which he sells for $10 a bushel. In 1953 his 100-acre crop was a total failure because of the prolonged drought. The 1954 drought was still more disastrous But, despite that fact, he produced 75 bushels of corn to the acre Reason in between seasons he had installed a $10,000 sprinkler-irrigation system He produced $75,000 worth of corn when otherwise his yield would have been approximately zero minus nothing.

He pumped the water from a nearby river through a line of aluminum pipe and a set of sprinkler heads He moved the pipe from one spot to another, watering an acre at a setting

Down near Centre, Ala, the Emory Johnson farm had over the years been averaging 1 bale o ton to the acre. This includ

humid years and dry years. By installing irrigation and using the water when he needed it, Johnson got 4 bales to the acre. This gave him a per-acre profit of $400 over the crops he had produced when he had to depend on rain-cloud moisture.

Now that's the real payoff. Even in years of normal rainfall no farmer gets the rain on every crop at exactly the time it will do the most good. Not only that, but there is rarely ever a year when every rainfall area of the country doesn't have some drought. Even in Mississippi where the average 50 inches a year is well above the national average, drought has had an important effect on crops in 39 out of the last 41 years.

Harold and Graydon Trible installed a $4,300 irrigation system for 90 acres of crops and pasture on their farm near Waterloo, Iowa. Despite the drought they made that first year 90 bushels of corn per acre which otherwise would have been a failure. But the beauty of it was they made 20 bushels more per acre than they had ever made before even during the best seasonable years. That was because they could put their man-made moisture into the soil at the very first signs of need. They could coordinate it with their cultivation, fertilization, and seeding without gambling on the clouds.

This interest in sprinkler irrigation is spreading over America's farm areas like measles. It promises to create a bigger upheaval in our agricultural economy than even the mechanized revolution that has transformed crop production from live horsepower to mechanical horsepower.

Impossible, you say? Well, get a load of this. With the old time flood-type irrigation which can be applied only on level land, less than 3 percent of America's tillable ground is irrigated. Yet that 3 percent produces one-fourth of the nation's agricultural products. When you realize that the sprinkler method can put water on any kind of terrain, regardless of how steep or hilly, the implications are enormous.

To show you how the idea is taking hold, Missouri's sprinkler-irrigated acreage has leaped 440 percent in four years; Virginia farmers installed 110 systems in 1954; Georgia has tripled her sprinkled acreage in the past two years and now has more than 1,000 systems. It is spreading that way all over the hitherto unirrigated U. S. The amount invested in this new method of strewing moisture was $55 million in 1954 alone.

Now, while these figures are impressive they are only a drop in the bucket to the vast number of farm acres that still wait on the whims of an unpredictable nature. They mean that a farmer doesn't have to resign himself to a total drought failure every third or fourth year and a partial drought failure every year. Agricultural experts predict that in the immediate future 15 to 20 times as many acres can be sprinkler-irrigated from existing or easily developed water sources as are watered by the flood-type method. Geologists tell us there is plenty of water to do so if we learn how to save it and use it.

Just what this will do to the average farmer's annual yield is indicated by the 1953 experience of W. N. Henderson of Ninety-Six, S. C. That was a year of extreme drought in his section. He sprinkled one field of corn four times and produced 110.6 bushels per acre. He sprinkled another one twice and got 73 bushels an acre. He watered another one not at all and got 8.3 bushels In short, he, like thousands of other farmers who are using it, found sprinkler irrigation the best answer yet to the crop man's prayer for water.

Now, the use of practically all this bonanza moisture has just developed in the past four or five years The question naturally rises, why didn't it start happening sooner? What have we been waiting for up to now?

• A time will come when the science of destruction shall bend before the arts of peace, when the genius which multiplies our powers, which creates new products, which diffuses comfort and happiness among the great mass of the people, shall occupy in the general estimation of mankind that rank which reason and common sense now assign to it

—Francois Arago

Well, they say necessity is the mother of invention and invention is the one dependable factor that has always kept civilization from being let down. The inventive idea in this case was aluminum pipe and the chief stimulus was the last three successive drought years when so much of the country was designated "disaster area."

Before aluminum became available in large and economic quantities we had to depend on iron or steel pipe to carry water from some place to somewhere. That kind of pipe was used to some extent to irrigate small acreages of truck where it had to be moved very little, if any distance.

But when you start lifting 30- or 40-foot lengths of 4- to 6-inch iron pipe you almost need a derrick. And when it comes to moving it over hundreds or thousands of acres of field crops for watering purposes, it simply isn't done. The cost would be prohibitive.

One man can lift a 30-foot length of 6-inch aluminum pipe and carry it from one spot to another as easily as a fence rail. It is only within the past decade or so that these new pipes have become available for widespread use.

While the methods will vary a little from farm to farm a typical irrigation set-up may include a pump, power unit, a certain number of feet of mainline pipe, another quantity of smaller lateral pipe, and enough sprinkler heads to cover about an acre at a setting

The pump and its power unit are installed on a river, stout creek, spring, well, reservoir or what have you. The water is pumped through a row of mainline pipe long enough to reach the field to be watered This main line has T-joints to which the smaller lateral pipe are joined at right angles Enough of these lateral pipes with sprinkler heads are usually joined up to cover an acre or so at a setting.

When an inch or more of thi
ficial rain is spilled — amo
pending on the condition an

the lateral pipe is unjointed, moved to the adjoining area, joined to new T-joints on the mainline pipe, and sprinkling action repeated. This may continue each night and through the cooler ends of each daylight day until the desired acreage is watered.

A word of caution here is important. Each farm to be sprinkler-irrigated has to be specially engineered for the specific situation found there. You can easily sink your wad into a pile of unengineered irrigation equipment and lose not only your shirt but your pants. A few farmers have already done that to their sorrow

Each farm has to be specially surveyed for the amount of water available, the number of acres the dependable supply will adequately water, rate of soil absorption, amount of lift required for water, size of pipe needed, number of gallons of water per minute you can get, and other things.

This engineering service is usually provided free by the local Soil Conservation Service, the manufacturing company that provides the irrigation equipment, or other sources. The county agent can usually tell you how this service can be secured

The cost of such a system will vary according to what the engineering figures of the farm survey show. But an average typical set-up on which a farmer can base his dreams for pushbutton rain is something like this:

A good average system that can handle 100 acres — assuming sufficient water is available — will cost approximately $10,000, or $100 an acre. It could be less or more depending on some of the factors already mentioned, but these are good general cost figures. In any number of drought experiences the difference made by this man-controlled moisture in crop production has paid for the entire installation the first year. Typical cost figures for operation, according to Clemson College estimates, would be about $8 to $10 per acre per year.

The question naturally arises, will there be enough water in years of extreme drought to give many farmers the benefit of this man-controlled moisture? Now, of course, it is easy to set a pump down by some creek well or pond, and pump it dry by spreading the water too thin over too much acreage.

This, of course, is the most important engineering fact that will have to be measured before the owner invests in an outfit. If the water-flow measurement indicates that he can adequately water only 2, 10 or 2 acres, it is to his interest to put his best paying money crops on that favored ground.

In short, a thousand-dollar-per-acre yield of tobacco or cotton on 25 irrigated acres may turn a year of disaster into a year of reasonable profit, even though there may be over a hundred acres in the farm that could not be watered.

For example, Jim McPherson, a truck farmer near Nashville, Tenn., has a 100-acre farm he cultivates to corn, pasture for dairy cows, and about 5 acres of tomatoes and other truck crops. Like other farmers in

his area he was severely hit by three consecutive years of drought. He constructed a $5,000 watershed reservoir which is just sufficient to adequately water the truck land. But these 5 acres of truck produce from one-half to two-thirds the entire net income of the farm which frequently amounts to $12,000 to $14,000 a year. So you can readily see how even a small amount of irrigation water can be made to go a long way.

Department of Interior experts say we have a lot more water resources around us than we realize In addition to the unused water that can already be pumped from our rivers, creeks and other places, there is a whale of a lot of flood water in seasons of heavy rain that we may some day find a way to store and salvage.

But in the meantime, the first irrigation developments will be in areas that already have nearby streams, adequate wells or other supplies.

The present boom in irrigation interest has already gotten engineers to dreaming up methods of getting vast quantities of the water that is now running off to sea onto our crop-producing acres. Jim Eleazer, agricultural information specialist of Clemson College, S. C., says it is utter nonsense for farmers to accept crop failures as unavoidable hazards. He says that only 14 percent of our rainfall is converted to gainful purposes.

Some authorities insist that a few major projects would bring other millions of acres into this watered bounty. For example, the mighty Mississippi and other large rivers could be tapped and water pumped into huge reservoirs in distant inland areas.

At any rate, the time seems not far distant when a huge percentage of our farmers in humid areas will no longer have to develop ulcers dreading the sizzling droughts that continually destroy their hopes and dreams of a profitable production

Gas-Turbine Racing Car

A sensational gas-turbine race car, the first of its kind, was unveiled and driven recently as a tire-test car by The Firestone Tire & Rubber Co.

Neatly packed into a conventional race car chassis, the turbine-powered "screamer" rocketed from zero to 140 mph in five seconds with veteran driver Henry Banks behind the wheel.

The revolutionary new race car was built by airmen of the famous Hobby Shop at Offutt Air Force Base, Omaha, Nebr Firestone engineers need the turbine-powered car for tire testing at great speeds

The car, with complete fuel load weighs 2,200 pounds The turbine motor weighs 125 pounds less than piston-type engine used in most cars The turbine motor is rated horsepower and does not need a tor or coolant

SODIUM: *Temperamental* METAL

by O. A. Battista

ONE DAY about 20 years ago, a group of chemistry students at McGill University, in Montreal, decided to put on a "fireworks" display. They had a bottle filled with small pieces of sodium metal, a soft lustrous cheese-like material that vanishes in a burst of flames when it hits water. With their supply of sodium safely submerged in kerosene, they headed for a bridge over a small stream that wound its way through one of Montreal's parks.

On location, one of the group produced a pair of tweezers. Piece by piece, he picked up the sodium from the bottle and threw it onto the water below As the sodium hit the water a gust of flames—burning hydrogen gas — shot upwards. Soon plenty of amazed spectators gathered about and the amused boys from the chem lab kept up the show until all the sodium was gone. This was the main purpose of their demonstration anyway. They wanted to get rid of the dangerous odd pieces of useless sodium that they had accumulated in the course of their experiments. They tried the bridge experiment just for a change.

I was the chemistry student in the group who manipulated the tweezers. Little did I know at the time that the metal I was throwing onto the water was to become a precious industrial commodity. For, during the past decade or so, metallic sodium has left the laboratory-curiosity stage and become a vital cog in present-day technology. More than 100 companies now are purchasing it to the amount of 300 million pounds a year. You can buy this industrial money-maker as 2-pound bricks or in 80,000-pound tankcar lots, and the production curve is headed almost straight up.

Sodium has become the temperamental element with 1,001 uses—all of which are tied to Mr. and Mrs. America. For example, sodium comes into the picture where dirty dishes, clothes on the line, nylon stockings, automobiles, airplanes, fuel tanks, drugs insecticides, and atomic-powered submarines are concerned.

The newest major use for this un-

seen metallic friend became public information when the Navy announced that 99.95-percent pure molten sodium is the unique heat-exchange medium piped through the *Sea Wolf's* atomic-powered engine. Why sodium?

Well, as a metal, sodium conducts heat and electricity especially well. Of far greater value, however, is metallic sodium's ability to soak up and rapidly transfer intense heat from one spot to a much colder area. This is the special virtue of sodium that has led to its extensive use in the Navy's *Sea Wolf* It is impossible to predict the volume of sodium that may go into the operation of tomorrow's atomic-powered engines and machines Certainly, here is one potential market that is paving the way for big things for sodium

The use of sodium-filled valves in airplane engines is already big business. The hollow head and stem of these valves is filled with sodium and then sealed. Because of sodium's excellent heat conductance the valves *are not warped at high temperatures.*

But the role of sodium in less spectacular closer-to-home uses is equally important and new. For example, numerous "soapless soaps" or detergents would not have come along in recent years without sodium's help This energetic chemical is powerful enough to change the oils that went into the old-fashioned soaps into certain alcohols that are essential ingredients in the manufacture of modern detergents. One result—gone are the days of streaky drinking-glasses or the telltale bathtub ring

There are, of course, many other ways whereby this interesting but little-known metal is affecting your standard of living. Those ingenious chemicals that can make water "wetter," the kind that can send a floating duck sinking to the bottom when a little is added to water, are products born of metallic sodium. These blood-relatives of detergents called wetting agents mean better-dyed, more uniform colored textiles, inks that write dry, stronger rubber and more potent germicides. Man-made indigo dye and many other synthetic textile dyes belong to the newer branches of the sodium family tree and the list of sodium by-products would take you a startling proportion of your lifetime to read.

One of the reasons there's a drug today for almost any pain lies in sodium's work behind the scenes. Without sodium—hundreds of tons of it readily available in sugar-pure form—healing sulfa drugs, barbiturate sedatives, anti-pyrines, antimalarials, even the popular antihistamines *would bow out.*

Have you heard any "pings" in your car engine lately? If not, chances are you use a gasoline containing tetraethyl lead, the large-scale production of which rests squarely on sodium's availability. The largest single-volume use for sodium is in the manufacture of tetraethyl lead, still the most effective chemical for taking the ping out of high compression gasoline.

Tetraethyl lead is produced by reaction of ethyl chloride and sodium-lead alloy.

Modern washing machines have run most of the blue out of Monday for most homemakers. Now there are new easy-to-use powdered bleaches to fight off telltale yellow from clothes thanks to another product of metallic sodium—sodium perborate. The new sodium-perborate-based bleaches are the latest in preventive measures against fabric discoloration. And they can be used safely on all types of washable fabrics. The paper industry now uses once-rare and now inexpensive sodium peroxide to give you your white letterhead papers and sanitary tissues

Thousands of steel products including the moving parts of such things as sewing machines, cars, typewriters, and numerous other common products have been made more wear-resistant by treatment in molten sodium cyanide baths. The electroplating industry utilizes millions of pounds of sodium as sodium cyanide each year to give us thousands of gleaming, useful products. So does the television industry where sodium cyanide plays a vital role.

High-surface sodium — still another important new development in the industrial use of metallic sodium, concerns a new method for depositing thin films of sodium on inert, high surface-area solids such as salt, soda ash, carbon, aluminia and sand. The resulting sodium-coated particles are free-flowing, and impatient to take part in chemical reactions, a molecular enthusiasm that is leading to dozens of cheaper products.

Shipping a *metal* in tankcars does seem hard to believe, but it is true for sodium because it melts below the boiling point of water. Despite this butter-like property, metallic sodium is, nevertheless, a true metal. The chances are good that one of the problems manufacturers of sodium will face in the not-too-distant future is, "How can we ship more than 80,000 pounds of metallic sodium per tankcar?" There is every reason to believe that some producers are preparing to answer that question.

Sodium is no longer the temperamental laboratory reagent that the chemist carefully stored under kerosene just a few years ago. It has taken its place as a major industrial metal. It has a tremendously exciting future. In less than 20 years many hidden virtues of the "useless" metal scraps of sodium that my student friends and I disposed of so ceremoniously from that small bridge in Montreal have been discovered. It is safe to say that the story of this pure, temperamental metal that slices with a knife has only begun.

An atom is less than 1/100th of a millionth of an inch in diameter, and its nucleus is about 10,000 times smaller than the entire atom.

• • •

The best shielding against either nuclear or atomic changes is material with high proportions of hydrogen Water or kerosene and similar fuels are 18 times better on a weight basis than iron.

Aviation Assaults the Heat Barrier

by Frank Harvey

Condensed from Nation's Business

THE AMERICAN aviation industry has quietly but intensively begun an all-out assault on the so-called heat barrier to supersonic flight.

A supersonic research airplane, the Douglas X-3 Stiletto, has been amassing hotspeed data for months. The Stiletto goes so fast it is reliably reported to use 2,600 horsepower (more than the total power of most World War II fighters) just to keep cool.

Current production models of United States Air Force and Navy fighters have already moved past Mach 1—760 miles per hour, the speed of sound at sea level—in level flight on power alone. Examples are: North American's Super Sabre, Grumman's Tiger, Convair's 102-A, McDonnell's mammoth single-seater Voodoo, and the still secret Lockheed F-104, reportedly good for speeds up to 1,500 mph

The problems of the heat barrier are therefore not wild-blue-yonder romancings which may develop in the 25th century. They are here now, with all their problems in ceramics, metals, refrigeration, fuels, electronics, propulsion, aerodynamics and allied fields These problems will grow constantly as the heat barrier is deeply probed

Nobody will ever "get through" the heat barrier while staying inside the atmosphere. It is a condition caused by friction of air on airplanes at very high speeds. The faster the flight, the greater the heat. Aluminum melts at Mach 5, steel at Mach 6, titanium and all other structural materials melt at Mach 8—and a diamond is formed into a puff of vapor 10—7,600 mph.

Nation's Business (May '55), 1615 H St , N W , Washington 6 D C

Engineers are not at the moment shooting at 7,600 mph — but plans for a Mach 3.5 airplane (about 2,600 mph) are reported to be already complete.

Why go so fast?

It's first of all a pressing military necessity. It would be dangerous if the communist countries developed a 2,600-mph airplane and we failed to equal or surpass it. The Russians have built large numbers of rocket fighters and have based them around their industrial complexes.

These rocket fighters go into the stratosphere like skyrockets, conserve fuel up there by gliding, and are capable of high supersonic bursts of speed during their intercept. When our B-47 stratojet bombers first flew, they carried no armament because it was felt that jet fighters could not catch them. The 47's now have guns. They may also shortly have Voodoo fighters for long-range escort.

Design of supersonic airplanes has already begun to show a "new look." Swept wings look rakish and speedy, and are fine up to the speed of sound. After you crack the sound wall and go on up to 1,500 mph, however, old-fashioned straight wings come back into fashion. They are built incredibly strong, are very stubby and very thin. They give low drag, resist heat deformation, and are designed for sleek laminar airflow, which keeps them 20 times cooler than burbling airflow. The X-3 Stiletto has stubby straight wings.

So has the Bell X-1, the fuselage of which is an almost exact blowup of the shape of a .50 caliber bullet. The F-104 is reported to have a sli (four-foot diameter) fuselage, stub by, straight wings, and a relativel low-power engine.

High-Mach airplanes will be expendable. The old reliable Douglas DC-3's were designed to last 20 years. Hotspeed planes suffer from a weird phenomenon known as "creep." When metals get hot they get soft and wander around like glue in July. The hotter the plane becomes, and the longer it stays hot, the more creeping of surface. You don't get 20 years service out of a high-Mach airplane. You may be lucky to get 20 weeks or even 20 hours. Creep deformation, since it is cumulative, sooner or later makes the airplane unsafe to fly.

Creep may create a big new salvage industry where tired planes are melted down, recast, re-machined, and re-assembled.

Materials, of course, are basic in the heat-barrier problem, and the surface has barely been scratched. Current top materials, with their technical designations, are: Titanium RC-130A; Inconel X; Aluminum 24S-T; 17-7PH steel; Multimet; Haynes Alloy 25 (L-605); and Cobalt alloy steel. Titanium is excellent under tension; Aluminum 24S-T is better at resisting compression and twisting; Inconel X, which contains a very high nickel content, retains its strength and corrosion resistance up to 1800 degrees Fahrenheit. An experimental airplane, totally clad in Inconel X, is reported to be flying at present.

A new internal bracing known as

an "all metal honeycomb sandwich," under advanced development by Solar Aircraft Co, San Diego, Calif., seems very promising in producing lightweight, high-strength, heat-resistant airplane components. Foil-thin ribbons are arranged in a honeycomb pattern to comprise the core, which is then sandwiched and fastened securely between metal skins.

The honeycomb sandwich is said to be remarkably creep-resistant up to 1650° F., and if the cell configuration is carefully chosen, a quarter-inch thick core with very thin ribbon metal in the honeycomb can stand the brutal pressure of two tons per square inch.

Some variations of the honeycomb sandwich are: the "porous skin sandwich" (one or both sides of the sandwich are perforated so cooling water can flow through them), and the "fluid-cooled sandwich" (it has solid outer skins but a maze of inside channels through which water can flow).

Thick pieces of metal tend to crack under the savage internal stresses set up when the outside of a piece of metal gets very hot while the interior remains cool. The solution lies in using a metal with a low coefficient of expansion — engineering language which means the metal can be heated without expanding or contracting much. Nickel, when added to steel in the proper proportions, reduces the coefficient of expansion to almost nothing. An alloy with 43.5 percent nickel has a coefficient of expansion half that of steel, and retains this property up to 800° F.

A metal called Invar has a coefficient of expansion 1/50th of steel, and is effective to 500° F.

F. R. Steinbacher and Louis Young, engineers for Structures Research and Development and Lockheed Aircraft Co., respectively, say in a joint study, "The development of low-expansion alloys might well make the difference between a practical aircraft and a structure too heavy to fly. At present no other metallurgical contribution to high-speed flight appears to offer greater promise or is more within the realm of possibility."

• In fact the knowing what kind of problem is worthwhile to attack is in general more important than the mere carrying out of the necessary steps
—Albert A Michelson

Keeping pilots, passengers and various systems (hydraulic, electrical, fuel, oil, electronics) cool in high-Mach flight is, of course, absolutely necessary. This isn't much of a problem in sub-Mach airplanes A subsonic airplane cools itself by giving off heat to the surrounding air. The engineers call the surrounding air a "heat sink," a sort of convenient drain down which they pour excess heat. As the airplane passes 1,500 mph, however, the air changes from a heat sink into a hot water faucet—and starts pouring heat back into the airplane.

One way to handle the matter is to duck the heat by flying high, in thin upper air, and holding speed for a very short time.

giving friction a chance to heat the airplane. Above 100,000 feet, however, air-breathing jets begin to lose power from oxygen starvation. Rockets are then the only practical means of propulsion, since they do not depend on outside atmosphere for power. Rockets offer terrific power in a small package.

To help in cooling high-Mach airplanes, engineers add powerful multi-stage coolers such as used in the X-3 Stiletto, insulate where possible, pressurize the fuel tanks to avoid undue loss due to vaporization, and then use the fuel supply itself as a heat sink. They soak up large amounts of heat in the fuel, then burn the fuel and get rid of it—very neat, as long as you don't flash your fuel and come apart in midair.

Needed is some new material which will have the insulating power of fiberglass, and still be able to stand up against the savage winds and pressures of high-Mach flight when used as an insulating envelope around the outside of the airplane.

Insulation is almost incredibly effective at high speeds. An airplane flying at 3,000 mph at 20,000 feet, with no insulation, will jump to 1250° F. in just 60 seconds That same airplane, insulated with the equivalent of one inch of glass fiber, can fly from Wichita to New York City in 25 minutes without heating above 500° F.—a temperature which cooling systems now available can take care of.

There are two kinds of airplane parts: "passive" and "active." The structure, skin, etc. are passive. The engine, electronics, etc. are active. Naturally the engine gets extremely hot without help from air friction. A ramjet engine—essentially a flying stovepipe with a minimum of moving parts—would be the best for hot-speed flight, but a ramjet wastes fuel, is hard to control, and won't even start running until air is crammed into its intake at virtually the speed of sound.

Rockets are fine for getting an airplane up to high speeds in a hurry, but rocket motors have only a few minutes before their fuel supply is gone — and a high-Mach airplane, with its great weight, stubby wings, and fantastically high landing-speed, is no airplane with which to make a landing without power.

The powerplant for high-Mach jets for the near future at least will probably be the turbojet. There is no point in trying to describe the working of a turbojet other than to say that the rotors in the compressor and turbine turn at very high speeds and if one tiny blade of the 1,000 blades in a single compressor wheel should break — the plane and passengers can be instantly killed. A turbojet engine gets very hot with no help from air friction.

Cooling of turbine wheels by passing gas or liquid through internal passages is being tried; certain engine accessories are being moved out of the hot zones; and an intensive study of blade design, ceramic material, and lubricants and coolants for turbojet engines at hot speeds is being made.

In peacetime transport airplanes

it may be possible to duck the heat barrier by flying high for short periods, but the military picture is different. If a raid of bombers is headed for the United States, it would be most embarrassing to find that the speed-time-altitude combination necessary to make the intercept would place the interceptor at the point of contact glowing like a neon bulb, with guns melted shut, rockets exploded, and the pilot fried to a delicate toasty brown.

Military airplanes should, if possible, be built to fly redhot if need be, without hurting the systems or the pilot. Some meteors come through the earth's atmosphere at extreme speeds, melt off a layer, and hit the ground without undue heating of the relatively cool inner structure Long-range guided missiles may be coated with a special skin which melts off in high-speed flight, and protects the shape and the internal structure of the missile.

Meltable skins may work well in missiles, but their application to current airplane design looks highly problematical.

The revolution in high-Mach flight will come in the shift in basic airplane material. At present, aluminum alloy is the backbone of the aviation industry.

Nobody yet knows what metals will build future airplanes. Titanium, currently produced in small quantities at high cost, seems to be the leading contender. Titanium is light, strong, corrosion-resistant, and stands up to heat.

However, the progress in metals, alloys and ceramics is taking giant steps now that the heat barrier problem is growing in urgency. Inconel X, for example, is good to 1800°
—while titanium begins to
ously weak at only 800° F

★ NEXT MONTH IN SCIENCE DIGEST ★

PROTEIN KEY TO LIFE

The word "protein" comes from a Greek word meaning "holding first place." It certainly does that, as far as life is concerned. This article explains what makes proteins so unusual.

HOW MULTIPLE BIRTHS OCCUR

According to statistics, in the U.S.A. twins are born once in 86 to 88 deliveries. But how and why do multiple births occur—twins, triplets, quadruplets, quintuplets? This article explains

WHY DON'T ATHLETES DO BETTER?

Sports College a non-profit service, has spent nine years testing 2,700 athletes of all kinds, analyzing player performances and calculating how they could be improved. Conclusion practically all performances in all sports could be improved by about 25 percent.

And many other fascinating articles about science and the world we live in.

Temperatures above 2000° F. render alloys almost useless because the ingredients which give them strength, corrosion resistance, heat resistance, and so on, either precipitate out at 2000° F. or unite chemically with other elements so that the whole structure is changed.

In case anyone is interested in developing or adapting materials to hotspeed flight, note the following: Gasoline boils in the stratosphere at a little less than Mach 1.5. Plexiglass, used extensively in bubble canopies, becomes plastic at Mach 1.6. Unless adequately cooled, engine electrical components begin to fail at Mach 1.65. Nylon and rayon lose their strength under Mach 2. Kerosene boils at Mach 2. Solder melts at Mach 2.25. Greases fail at Mach 2 2 Fuels automatically ignite at Mach 3.5, and at Mach 3.7 glass softens. All these materials, if improved, offer chances for new business ventures.

The engine itself is open to great improvement. As things now stand, the engine and fuel necessary to reach high-Mach speeds comprise the major part of the total weight of the airplane, leaving little room for payload. At 300 mph the engine and fuel take up 20 percent of the airplane's weight. A 900-mph airplane must devote 65 percent of its total weight to engine and fuel. And 900 miles an hour is still outside the heat barrier beginning in earnest at 1,500 mph.

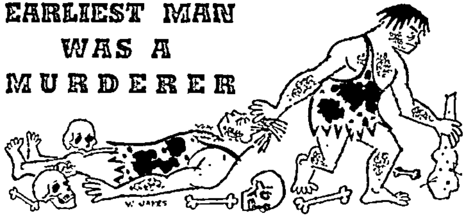
The field for aerodynamic designers is promising. Design becomes very important as speeds climb. If the airflow over the surface of the airplane can be held to the laminar condition (a smooth, sleek envelope of rushing air) the airplane heats up 20 times less drastically than when the airflow is allowed to burble and become turbulent.

Nuclear-powered airplanes which can stay up indefinitely and fly at tremendous speeds are currently shrouded in complete secrecy, but we may be sure the United States Government, through its agency, the National Advisory Committee for Aeronautics, is working on atomic powered airplanes. These planes will be the forerunners of space satellites —and will be of decisive military significance.

How soon will hotspeed planes be a reality? High-Mach flight is on top of the USAF's priority list. The best brains—backed by billions of dollars—are working steadily on the problem. The designs, fuels, power plant, systems, coolants and the other materials to build a Mach 3 airplane are reliably reported to be on hand at this moment. It is possible—although not probable—that a Mach 3.5 airplane is sitting inside a secret USAF hanger at Edwards Air Force Base right now.

THE SCARLET TANAGER is nicknamed "Robin-with-a-sore-throat" because of its hoarse caroling.

EARLIEST MAN WAS A MURDERER



by Robert Ardrey

Condensed from The Reporter

In Johannesburg in South Africa, an explosive story is being written It is a story translated in old caves from ancient bones Its thesis is all too simple: that the earliest human activity was murder.

I first heard rumors of the story from a friend on the faculty at Yale. I was appalled at the philosophical fallout that such a thesis, if proved, could produce. Beyond a few evasive scientific papers there was nothing to read about the matter. The discoveries in the Transvaal had been so recent that only a few of our anthropologists had seen even a portion of the evidence. In New York I talked to one of these, the great Pere Teilhard de Chardin. In London, at the British Museum, I consulted that arch-skeptic Dr. Kenneth Oakley, illuminator of the Piltdown hoax.

Oakley armed me with a modest background on the subject, a few more scientific papers, a battery of reasons why not—and a plaster cast of the top of somebody's cranium cracked at an early date by what might be either the teeth of an extinct carnivore or a short, sharp weapon.

Several weeks later I arrived in Johannesburg. I needed the time to gain a first idea of the creature—ape man or man ape—whose ancient remains and significant ways might shake man's conception of himself I needed more than the time to learn without gasping to pronounce his name—Australopithecus.

I STUDIED the literature He had been a little fellow, four feet tall. He had lived in early Pleistocene times, perhaps three-quarters of million years ago, before the earl known human being His hom been the treeless veld, no pla

The Reporter (May 5, '55), 20 E 42nd St, New York 17, N Y Copyright 1955 by Fortnightly Publishing Co, Inc

apes. His teeth were human; he had no fighting canine teeth. No anthropoid ridge bisected his skull. He stood erect, and like man, he was carnivorous. Of all the modern apes, only the baboon in time of famine will turn from the vegetarian way.

Australopithecus means "Southern Ape." Why had he been classified as an ape? There was a single reason: his brain. The creature's cranium was half the size of modern man's.

Nevertheless, for 30 years one controversy after another had flourished about the creature and about his discoverer, the legendary Dr. Raymond A. Dart. In the beginning a single skull had been found, that of a six-year-old child, on the edge of the Kalahari Desert. Darwin himself had suggested that the human species may have originated in Africa, but in the 1920's world attention was fixed on the plains of Asia. A single immature skull was insufficient to distract it.

But then in recent years, and in rising tempo, cave after cave and specimen after specimen were discovered in the Johannesburg area. Some were found by Dart, more by Dr Robert Broom and his successor, John Robinson of the Transvaal Museum in Pretoria. Today the remains of 50 Australopithecine individuals have been found and verified, and perhaps a hundred more are indicated. Scholars must place a stray jawbone in Asia against an entire society in Africa.

Which was the birthplace of man, the veld or the steppes? Opinion has swung sharply. Was this a pro sive ape or a primitive man? ‌\ once was sure is sure no longer. ‌] nitely the creature has been recl fied from anthropoid to homin tending toward man. Did he in make use of fire? Dart had cla so, but Oakley has largely dispr it.

What was the nature of his in gence? Brain size is no longe garded as an absolute criterion the creature had left no tools.

Dart had interpreted certain b recently found in Australopith remains as weapons. Animals u: weapons. Dart advanced his th in 1949. Lightly documented, it lightly received. The claim pa over into rumor. Curiosity had kindled in the north, but mu: budgets permit few junkets to sc ern Africa for the purpose of inv gating rumor. And little more heard from Dart.

I ARRIVED in the Transvaal at Africa's most famous anthroj gist is not a professional ant pologist at all. Dr. Dart is hea the department of anatomy at University of the Witwatersrand is a healthy, pink-faced, blue-e sandy-haired doctor. He is rega by many of his fellow townsme slightly mad and by much of i national science as a remarkable gifted but somewhat unreliable a teur.

In our talk, Dr. Dart rattlec certain physical details concer Australopithecus as if quoting f his own papers. I interrupted hi

apologize for my deplorably limited background.

Doctor Dart looked at me as if I were an odd sort of patient. I proceeded to explain that perhaps because I was just a curious layman the quality in his discoveries that had fascinated me was their overtone. If his interpretations should come to be accepted as correct, what would happen to all those conceptions of man premised by innate goodness? I couldn't tell whether Dart was listening or not. He was looking out the window. Then he laughed a little and said, "Do you know, you're the first layman who's ever come to me who cared about the end of it?" In a moment he was pulling open drawers and rolling out skulls like apples.

"Baboons," he said "Australopithecine cave deposits are one enormous bone-yard All mixed together, the fellow's bones and the bones of all the animals he slaughtered, that have turned through the ages into a rock called breccia. There's a thousand tons of breccia up at Makapan alone Now these baboons. We have over 50 specimens Eighty percent are the victims of instrumental violence."

THE ANCIENT BABOON gaped at me. The top of his skull was caved in. I had been prepared up north for this one.

"Rock falls," I said.

"Yes," he said. "Robinson can show you a fellow over at Pretoria with the whole top of his head bashed in, and he can show you the rock that fell from the cave roof and did it. But you'll see this one's an inch or so across, and this one's typical How far would a rock that diameter have to fall to smash in a skull? No. I can show you specimens that have been struck again and again by the same weapon. And what's more there've been three times as many baboons struck on the left side as the right. Australopithecus was right-handed."

I groped for my northern reasons why not, while specimen after specimen went through my hands I had the sense of being a coroner at some long-belated inquest, fingering the evidence while the timeless detective, Dart, prowled through the corridors of sudden antique death

"He killed," said Dart. "Methodically, systematically. He lacked fighting teeth Why? It's as Darwin predicted. Because he didn't need them He'd discovered manual weapons Look at these"

Photographs appeared before me

"Hipbones," said Dart "The ape Round and narrow. Australopithecus Broad and flat, like a man today. You may consider that fatty mass that adorns the rear as useful only in the spanking of children. No, because he'd developed a human rear, Australopithecus could stand solidly, erect and balanced, while he hurled, thrust, or swung a weapon. The ape can do none of these things"

"Do you consider this the diff ence between apes and men?" asked. "The back end?"

"It's a mighty one," said "But of course no It's the

that counts. And this chap had a half-size brain. He was no man. He was a proto-man."

Dart considered the view from the window. "What you must try to grasp is this," he said after a moment. "It was his unique capacity to kill with a weapon that set proto-man apart from his fellow animals. The greater brain came later — perhaps only a little later — to satisfy the complex demands of the confirmed and specialized killer."

Weapons had produced man, not man weapons.

My mind wandered. Thunder rumbled across Johannesburg like a train going nowhere. I stumbled through the terrifying logic of Dart's statement. The tall windows darkened. Dart turned on the lights.

In my hand was a jawbone. The front teeth were missing. "Australopithecus," said Dart. "A 12-year-old boy. You can feel the dent where the bludgeon hit him. Knocked out his teeth. See the fractures on either side."

I felt the dent. His jaw had been crushed by the blow. "They cherished each other about as much as they cherished the baboons," said Dart. "Sometimes one got it on the side of the head, but mostly it was on top. Here's one on top."

He was holding a brain-case with a deep double indentation. The force of the blow had fractured the skull at the side and caused it to overlap. I grasped at Oakley and northern skepticism.

"This is still surmise," I s "Everything hinges on weapons.' evolvement of man. The murde a boy. Animals may somehow h done this. Some extinct carni may have snatched these fellows on the veld. Leopards use ca These were little creatures. Leop: may have caught them, banged tl about, caused the head inju brought them back to their ca The whole bone deposit could b been of animal origin. You can't it out, so long as you don't have weapons."

Dart nodded.

"I've made myself a bit of tro on more than one occasion," he s "This thing of speaking too soo suggested much of what I've told some six years ago. I had my nipped. Would you care to c downstairs?"

On the ground floor of the m cal school there is a long co dor. We entered a small room wh two students were dissecting a c temporary dead man. We moved to a larger room.

In box after box were bones—h dreds upon hundreds of fossil a mal bones, cleaned and identified cataloged and distributed in boxes like cards in a file. "W been working," said Dart. "Th are all from Makapan."

It was like an arsenal assemb by police after a busy night of r ing. Here were the early blackja the original razors and daggers lead pipes of the Pleistocene ho lum. Heavy thighbones of big

telope, the knuckle ends worn and frayed from bludgeon use. A slighter bone, split to a point like an icepick. Long, sharp, spearlike antelope horns broken off from the skull. A pig's jawbone, toothless except for the jutting canine like a dreadful gutting hook on the end.

"Couldn't this still be surmise?" I said I hesitated, because I didn't believe what I was saying. "Couldn't we be reading things into this?"

He got out his deadly charts. Some 3,500 bones had been cataloged. A glance was enough No leopard had assembled this jungle of bone to delude future scholars. Intelligence had decreed what bones would be found in the cavern at Makapan and what bones would not. Australopithecus had brought home only those bones useful to his arsenal.

"Notice this one," said Dart He handed me half a jawbone It was small. The teeth were as sharp as the *knife it undoubtedly* was. "*That's* from a very small extinct buck, a kind of gazelle," he said.

"The teeth are filed!" I said

"Maybe," said Dart.

"They're filed!" I said. "They're filed along one plane, like a scissors blade! This must be one of the first shaped tools"

"I wouldn't know," said Dart. "I can't prove it. I'm concerned these days with things I can prove. What interests me is that we've found those jaws by the dozen. And not a gazelle hipbone. Too fragile. Our fellow couldn't use them. He brought home nothing but this."

More than an animal, Australopithecus had known what he wanted — the lethal weapon Less than a man, he had been unequal to the demands of his discovery, and had passed into the breccia of prehistory I stood for a long time looking at the razorlike weapon in my hand, while Dart mused through his arsenal and the old philosophies tumbled in ruins.

WHAT was the nature of the mutation known as man? He was a creature selected by natural history to perfect the deadly weapons *that a predecessor had discovered.* Overwhelmingly, he has been a success Half a million years of carnage pay tribute to his zeal

"When are you going to present all this?" I asked

"When I'm ready," Dr. Dart said.

Decodes Signals at 100,000 Words a Minute

A new electron-image tube that can translate coded signals from tape, keyboard or radio into clearly-defined letters and figures at speeds up to 100 000 words per minute for high-speed photographic recording has been announced

The new tube developed at the David Sarnoff Research Center of RCA, fills an acute need for high-speed printing devices operating directly from data in

in electronic message transmission computing systems Further dev ment is expected to fit it as an tronic means of typesetting

Condensed from Aramco World

THE SUN had been in the sky for more than three hours, and members of the oil exploration party could feel the heat from the sand burning through the thick soles of their shoes. Suddenly, one of the men pointed to a tall hill off in the distance. The geologists looked at their contour maps to check its location As they expected, it showed nothing but sandy flatness for miles in all directions. They advanced, and the formidable hill slowly dissolved into an insignificant mound.

Later in the morning the same group was diverted by the sight of a huge lake stretching out in front of them as far as the eye could see. They did not bother to get out their maps again. No matter how detailed and accurate geographers make them, no map will ever indicate the existence of a mirage in the Saudi Arabian desert.

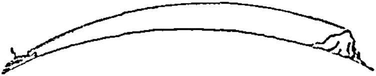
Aramco World (Apr. '53), published by Arabian American Oil Co., 505 Park Ave., New York, N. Y.

In the spot where the group stood that morning all elements necessary for the formation of perfect desert mirages were present. For one thing, the location was level, right out to the edge of the horizon. For another, the air was perfectly calm. Thermometer readings indicated that the temperature at the surface of the sand was very high, but the heat while still intense, decreased rapidly as more measurements were taken every few inches up to a height of two or three feet above the ground. This satisfied the third condition required for a mirage in the desert: the temperature changes in the air immediately above ground level were abrupt enough to cause a rapid variation in the density of the surrounding air.

A child looks down into a goldfish bowl and sees fish swimming in it life-size. He looks *through* the bowl, and the fish seem to be huge. The same fish appear so much bigger

IT ISN'T WHERE YOU SEE IT!

THE INFERIOR MIRAGE, common in deserts, depends on light rays bending upward.



THE SUPERIOR MIRAGE, seen over icy waters, depends on light rays bending downward.

THE DOUBLE MIRAGE is a rare combination of the two types.

when viewed from the side because the water in the bowl is "denser" than the air outside, and has caused the direction of the rays of light traveling through it to bend downward. This refraction of the light apparently brings the fish closer to the child's eyes than they actually are.

Given the flat desert and enough ground heat, much the same thing happens to cause a mirage But instead of light rays changing direction as they go from air into denser water, they "bend" as they run into the different densities of air above the hot, sandy surface Light rays from the sun, coming in at an angle, slow down or "drop" as they cross the thin, low-lying layers of superheated air which acts like a mammoth, broad-based prism. This light penetrates to the observer by a curved path which skims the earth as if the earth were a flat mirror What the observer sees under such conditions is an optical illusion—objects some distance away mirrored on the hot layer of the air, the "reflecting area" Images of palm trees, piles of rock and similar fixtures on the landscape are displaced and distorted, so that they appear much taller than they actually are the low distant sky reflecting on still, heated air often appears

a large body of shimmering water.

When the reflecting area is below the eyes of the observer, as it is on the desert, the optical illusion created is called an *inferior* mirage. This type of mirage is often noticed by train travelers as they near the Great Salt Lake in the state of Utah. Approaching from the west, they are amazed to see the tracks over which they have just passed disappear beneath the shimmering surface. And those small puddles which loom up in front of your automobile as it moves along a flat, hot road are in reality miniature inferior mirages.

During Napoleon's Egyptian campaign his soldiers were so badly frightened by their first sight of a desert mirage that they thought the world was coming to an end, and, according to contemporary accounts, promptly threw themselves on the ground and started to pray. It was Gaspard Monge, a French engineer along on the expedition, who attempted to explain the phenomenon.

This same so-called inferior mirage also played a decisive role in one phase of the First World War. During a battle between the English and the Turks in Mesopotamia on April 11, 1916, a mirage caused the enemy to vanish completely out of sight of the British artillerymen. One reason mirages have always been so mysterious, subjects of many a "tall tale," and a standard inspiration of magazine cartoonists, is their very elusiveness. To Arabian American Oil Co. people who work in the desert, the mirage is a very commonplace experience. They can supply vivid verbal pictures of mirages, but none of them has succeeded in capturing on film that which the eye sees.

Sailors frequently report seeing ships, icebergs, cliffs, shorelines, towns and even buildings which would normally be over the horizon, looking reasonably close at hand, and suspended from the clouds, either upside down or as double images—one upright and the other inverted. Such illusions, known as *superior* mirages, occur when the reflecting area is higher than the eye. They are caused by atmospheric conditions exactly opposite to those responsible for the desert phenomena. Very cold water in the higher latitudes chills the air lying just over its surface. The temperature of that air increases in an upward direction. In this case, the "mirror" is above the observer at a level in the atmosphere where the sun's rays are strong enough to counteract the effects of the cold water chilling the air below.

There is another kind of mirage, the most spectacular of them all, which is caused by the coexistence of the temperature disturbance peculiar to both the inferior and superior varieties, and produces the types of optical illusions seen on the desert and in cold-water latitudes at one and the same time. It is commonest in the Strait of Messina, the narrow stretch of Mediterranean separating Sicily from the Italian mainland, where the water often happens to be very warm. Under perfect conditions, simple fishing cottages on the shore appear as wondrous castles—half in the sea, half up in the air.

Rainbow-Colored Auto Engines?

Automobile engines and their parts may become more colorful than the new car bodies if the ideas of a University of Illinois professor take hold But the purpose will not be decoration, it will make assembly and repair easier.

The idea grew out of research done for the Air Force by Prof Lawrence Stolurow, U. of I psychologist, and Charles Hopkins and William Sawrey, graduate assistants

They found that much assembly and repair time is lost because parts are so nearly alike they are confused

Diet for Plants

Plants used to decorate the home can be made to look better, if they are put on the right light and water diet

In a series of experiments with 43 popular indoor plants, Dr. O Wesley Davidson of Rutgers University found that plants can be "trained" to remain attractive when put on a strict water and light diet.

The water training or adaptation means keeping the soil "moderately" dry the research specialist in floriculture said Double pots with moss in between was found to be an effective method of giving the plants only a

cent and incandescent light combined give the most desirable results for keeping leaves lustrous and maintaining slow growth

The 43 plants, all of which were kept on a near-starvation water diet for 20 months, fell into three groups, depending upon the amount of light intensity each needs

Seventeen plants, termed the hardiest, require from 15 to 25 foot-candles of light These include Dumb-cane, three varieties of corn plants, two Chinese evergreens, and four kinds of Philodendron vines.

Sixteen other home plants survive, looking their best, with medium light intensity of from 25 to 50 foot-candles Included in the second group were three more Chinese evergreens, a Diffenbachia, three varieties of Watermelon Begonias and two more Philodendron vines.

The last ten of the plants tested require from 50 to 1,000 foot-candles These include three kinds of Ficus plants, cousins to the fig plants and India rubber plant, and two ivies, English and Maple Queen

The foot-candle output per watt, it is pointed out, is much higher for fluorescent lights than for incandescent lights Meters are available for measuring the intensity of illumination.

Doctor Davidson also found that the use of fertilizers for indoor plants should be rationed along with the amount of light and water No mor than one-third the amount of ferti for the same plant growing outdoo required for keeping the indoors i tants from becoming ungainly.

Answers to PHOBIAS Quiz

The Questions Appear on Page 53

1.—c	6.—c	11.—a
2.—a	7.—b	12.—b
3.—b	8.—a	13.—b
4.—a	9—c	14.—a
5.—c	10.—b	15.—b

Most Unwanted Insects

Twenty-three states have made known their most unwanted insects. The public enemies of the insect world were greatly responsible for the more than $4 billion-worth of insect damage suffered last year.

Dominating the lists compiled by state entomologists were the corn earworm, grasshoppers, aphids and mites. The corn earworm, also known as the bollworm, made 16 of the lists. Grasshoppers were listed by 14 states, including Wisconsin, Indiana, Tennessee and Arkansas, which are not normally included in the Grasshopper Belt.

House flies or livestock flies made 14 of the lists; cutworms, 11; armyworms, 9; aphids, 15; and mites, 13.

Insects are placed on the most-unwanted list by tabulating the damage caused by the insect, its potential for damage and the need and cost of control.

Bees' Air Conditioning

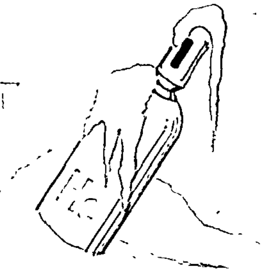
Man developed air conditioning in the 20th century, but nature's engineers thought of cooling systems and other modern conveniences many years ago.

The industrious honeybee, associated with people for more than 40 centuries, [illegible]

flutter tirelessly. The air circulation maintains a pleasant atmosphere for brooding bees and removes excess moisture that would ferment the nectar.

In winter the colony devises its own central heating. All the bees cluster around the queen. Those on the periphery press together to form an insulation shield; bees inside mill around to generate heat. The lower the temperature, the harder they must work. But the insulators and heaters change places frequently.

World's COLDEST Curiosity



by Earl Ubell

Condensed from the New York Herald Tribune

A 36-YEAR-OLD physicist has figured out a mathematical explanation for the world's coldest curiosity: liquid helium. Dr. Richard P. Feynman, professor of theoretical physics, discussed his work in his office at the California Institute of Technology

Such mathematics, a special kind used in describing what happens when an electron smashes into an X ray or light ray, has already won him an Albert Einstein Award. He also applied this variety of mathematics to the building of the atomic bomb.

Now Dr. Feynman has gone to work on liquid helium, that weird stuff that exists only at 452 degrees below zero, Fahrenheit, in a special triple vacuum bottle known as a cryostat. The coldest recorded natural temperature is somewhere near 80 below zero But 452 below exists in the laboratory Scientists obtain this temperature by high-pressure pumping

Helium, the world's lightest gas next to hydrogen, is, unlike hydrogen, chemically inert. It can be turned into a liquid only at 452 below and solidified at that temperature under 375 pounds per square inch of pressure. As a gas, helium is not much different in its reaction to cold from most other gases—hydrogen, nitrogen, oxygen — except that it takes a lower temperature to achieve liquefaction

But here are some of the peculiarities that experimental physicists have discovered about helium in its liquid state.

First, if liquid helium is put into a little open jar inside the cold vacuum bottle (the cryostat), the liquid will creep up the sides of the jar and down the other side as though defying gravity. No other liquid d this under any condition

At 452 degrees below zero liquid helium is just seven degrees above the absolute limit of coldness called absolute zero by scientists. Nothing can ever be made colder than absolute zero by any means now available or theoretically possible.

When helium is cooled to three degrees above absolute zero by evaporating some gas from its surface (that's like cooling soup by blowing on the surface), the behavior of the liquid is even more weird. Ordinary liquefied gases boil vigorously as bubbles of gas form and rise to the top. Liquid helium at three degrees stops boiling but still the gas comes out.

Liquid helium will flow through a microscopically thin long tube as though the tube offered no resistance. For this reason it is called a superfluid. Ordinary fluids would have to be pushed through such a tube with some force. The liquid helium acts as though it had no viscosity, that is, thickness. But it does have viscosity, because a whirling paddle will slow down in the fluid as if the fluid were molasses.

But most curiously, liquid helium does not appear to carry any heat through that long thin tube. If two jars of helium are connected by such a tube and the level in one is higher than the level in the other, then levels of liquid helium will tend to equalize as the gas flows in liquid form through the tube. However, the jar toward which the helium is flowing gets colder even though both were at the same temperature to begin with.

About ten years ago two physicists, one an American, L. Tisza, and the other a Russian, Dr. L. Landau, tried to explain all this in a way that was not principally mathematical.

Doctor Landau said that at very cold temperatures below three degrees the liquid helium could handle energy in only one peculiar way: with bundles. These bundles he calls phonons. If you can imagine the helium atoms in the liquid as little balls then the phonons are the waves of energy that scatter among the balls as they draw close together and then disperse.

As the water wave is bigger than the water molecule so the phonons are bigger than the helium atoms. They are called phonons because they are like sound waves but rather than going in a particular direction they scatter throughout the helium. The lower the temperature the fewer the phonons and the less the energy.

With this, some of the helium's behavior can be explained. The liquid helium can flow through a long thin tube because the individual helium atoms don't jiggle—they have no energy. The phonons are too big to get through the tube. They stay behind among the remaining atoms and tend to heat up the collection.

Why does liquid helium creep up the sides of the jar? Like any liquid, the helium can stick to the walls of the container. Being so cold, it doesn't evaporate. Thus it forms a thin plate between itself and the glass wall. The energy-less, jiggleless helium atoms just flow through like water through a siphon.

What has Dr. Feynman done? He has shown that the phonon explanation is essentially correct. He has also demonstrated mathematically that the helium atoms between three degrees and seven degrees can hold energy in another way: by moving in collections shaped like smoke rings called rotuns. And he has tied the whole thing together in a neat mathematical bundle that obeys all the laws of atomic physics.

The mathematics he has used is called quantum mechanics, a technique that has been used to explain every atomic phenomenon that occurs outside the atomic core, the nucleus Until now helium has resisted such a description. Now Dr. Feynman says he has done it.

Ten years ago Dr. Mark Zemansky, a physics teacher at New York City College, told a class that a Nobel Prize awaited the man who could work up a good theory for liquid helium and another low-temperature curiosity called super-conductivity. Super-conductivity describes the fact that at temperatures near absolute zero certain metals lose all electrical resistance and can carry an electrical current indefinitely No one knows why

But in explaining liquid helium Dr Feynman has done half of this "Nobel" job.

The Case of the Gold-Filled Pebbles

Part of the Mississippi State College chemical laboratory also doubles in brass as a state chemical laboratory As such, it is often called on to perform tasks of chemical analysis ranging from horrifying to unusual to downright bizarre In the latter class is an incident attributed to veteran chemist Sam Few

A man once sent in a very ordinary-looking pebble with the request it be analyzed He had acres of the things, he wrote, and every time he cracked one open he found a yellow speck inside He just wanted to know if it could possibly be gold! If so, how much would a pasture covered with such pebbles be worth?

Chemist Few suspected the man of trying to trick the laboratory into sending him a letter for possible use in a confidence swindle Nevertheless, Few took the rock into the laboratory and struck it with a hammer It split neatly down the middle There was a bright yellow speck right in the center He then took half the sample and analyzed it It contained gold

Then he placed the other half in a crucible and heated it A smell alien to either gold or an ordinary pebble—the odor of burning glue—clogged his nostrils.

Few nodded to himself and wrote the following report "The sample did contain gold, but as far as value is concerned, it was hardly worth the tr of splitting the pebble open and a piece of gold foil on the insid

—*Chemical and Engineeri*

a science milestone

Charles Messier

"Ferret of Comets"

by Simone Daro Gossner

Condensed from Nature Magazine

THE LATTER HALF of the 18th century was one of the greatest epochs in French astronomy. The names of Laplace, Delambre, Clairaut and de Lalande, to mention only a few, still rank among the most important in the history of their science. But there were also many others who, like Messier, were more concerned with the accumulation of observations than with the interpretation of their results.

Such painstaking work has always been essential to the progress of astronomy. The observer himself, however, often remains unknown to posterity. If it had not been for an unforeseen turn of events, Messier's name long ago would have been forgotten.

Charles Messier was born in Badonvillier, in Lorraine, on June 26, 1730, the tenth child in a family of twelve. His father died in 1741, and an older brother looked after his education. When he was 21, Messier came to Paris to work for the astronomer Delisle. In those times, astronomers were often cartographers as well, and Messier's first assignment was to copy a chart of the Great Wall of China, and to reduce to one-fourth a huge map of the city of Peking. The map was so big that his office was too small to accommodate it, and he had to work in an unheated hallway. Unaccustomed to such lack of comfort, especially in the wintertime, the young apprentice found the going rather rough. But the experience served to toughen him up for the long nights he was to spend at the telescope later on.

When Delisle ran out of maps to be copied, he decided that the time had come to give Messier his first instruction in the use of telescopes. Messier was an apt pupil, and soon became a skillful observer.

At that time, astronomers were interested in the first predicted return of Halley's Comet, which was expected early in 1759. Delisle had devised several methods by which the comet could be detected with a tele- [illegible] to the [illegible] Messier did zealously for a year and a half. But Delisle's computations fell short of the mark, and Messier's work was mostly in vain. The comet was sighted in Germany, in December, 1758, and again in the following month. No word of this reached Messier, however, and he observed Halley's Comet independently on January 21, 1759.

Nature Magazine (May '55), published by the American Nature Association, 1214 16th St., N.W., Washington 6, D.C. Copyright 1955.

DELAVAN'S COMET, September 20, 1914; showing its huge divided tail

The list the astronomer compiled contains all the brightest and best known nebulae and stellar aggregations the structure of which has been revealed by the modern telescopes. Each one was assigned a number in the order in which Messier had added it to his list, and even today they are still designated by that same number, preceded by the letter M in honor of Messier.

These Messier objects fall mostly into five categories—galaxies, globular clusters, open clusters, diffuse nebulae, and planetary nebulae.

The best-known galaxy is undoubtedly M31, the great spiral in Andromeda. Another familiar one is M51, the Whirlpool nebula. It is located in the constellation Canes Venatici, and can be seen easily with a six-inch telescope and low-powered eyepiece.

Globular clusters are huge concen-
s of stars, spherical in appearance, as their name indicate
Single clusters average at least 100,
000 stars, and could conceivably con
tain as many as a million. Our Milk
Way system includes about a hun
dred of these clusters. Almost all o
these were discovered by Messi
and the Herschels.

The Hercules cluster, M13, is vis
ble to the naked eye, but the observ
will require a star map for its ident
fication, at least on his first attemp

Open clusters are loose assembli
of stars, which share a common m
tion in space. The most familiar e
ample is M45, the Pleiades Othe
such as M44, Praesepe in Canc
may be seen with a small telescop

Diffuse nebulae are true nebulos
ties that derive their light from t
stars imbedded in them. They a
found exclusively along the Mil
Way, and in the spiral arms of out
galaxies The large Orion nebul
M42, is faintly visible to the nak
eye, south of Orion's belt. It is mo
than a thousand light-years away.

Planetary nebulae are rare and i
teresting objects. They appear

BROOKS' COMET, November 2, 19

the shape of a gaseous ring surrounding a star. Their name originated from the theory that planets could possibly be formed by the gradual cooling of this outer ring. A six- or eight-inch telescope is sufficient to reveal the general appearance of such planetaries as M57, the well-known Ring nebula in Lyra, or M27, the Dumbbell near Cygnus

The position of most of the Messier objects may be found in Norton's *Star Atlas*. Their observation can be a fascinating experience to anyone who has access to a small telescope, even though the detailed structure of these nebulae and clusters can be revealed only by larger instruments.

Messier's *Catalogue* was, however, ignored by most of his contemporaries, who, like him, saw in it no more than a list of nuisances.

HALLEY'S COMET, May 10, 1910

The French Revolution brought great financial stress to many French scientists The Royal Academy was abolished, and Messier lost his pension and his salary A widower, without children, he was cared for by a niece. He suffered a stroke in 1815, and died at the age of 86, on April 12, 1817.

Atomic Menace to Heredity Ten Times Greater?

Radiations from atomic bombs, radioactivity and X rays are a ten times greater menace in causing hereditary changes than heretofore estimated, it is suggested in the AEC semi-annual report.

Experiments at the Oak Ridge National Laboratory show that mutations that occur in mice as the result of radiation occur at a ten times greater rate n those observed in fruit flies, on which most of the estimates of radiation damage to human heredity have been based

The changes in hereditary constitution due to these mutations or permanent changes in the germ cell make-up are one of the most feared long-time consequences of too much radiation, such as might be spread in the world by an excessive number of A- and H-bombs in war or peace or too much atomic power reactor debris

The AEC has revised its estimates of the genetic hazards of radiation to hu- [illegible]

continuing its testing of the mutation rate in mice using lower doses of radiation such as might actually be encountered —*Science Service*

Inventions Patents Processes

Filter Reduces Dust Problem

A small portable device, said to remove more than 99 percent of all smoke, dust, pollen and even some types of bacteria from room air, is finding use in industrial plants and laboratories.

The unit, a product of Raytheon Manufacturing Co, Waltham, Mass, was originally designed to relieve the discomforts associated with hay fever, asthma and other allergies Since its introduction, however, the "Micronaire" has been successfully adapted for use in many segments of the electronic and chemical fields where dust-free atmospheres are required

The cleaner is an electrostatic precipitator, trapping all airborne particles by a form of magnetic attraction, rather than by mechanical filtering. Particles measured in microns, which would pass through an ordinary filter, are trapped by the charged plates of the "Micronaire," company officials claim Plates are easily removed and washed when excess dust accumulates.
—*Industrial Laboratories*

How To Find a Short-Circuit

Changing a fuse can be a perfectly safe operation, or it can be fraught with danger. The common fuse for home circuits is 15 amperes. Wh of them blows, it should be re by the same capacity fuse, r pennies or wire.

Always turn off the master when a fuse blows.

Your problem may be a short-c or it may be an overloaded circu find out, you insert a 25-watt b the socket from which you remov bad fuse.

If the bulb burns dimly, you h overloaded circuit and should c nect some appliances If it brightly, there's a short-circuit house, and another fuse inserted those conditions will blow out inst

To find the appliance with the circuit, unplug your appliances c a time and check the brightness test light. When the light dims have found the troublemaker.

If you have made both these c and the fuse still blows, your tr is more serious. Call an electr The problem may be inside the wa

Don't try to change fuses i dark Keep a flashlight near the box.—*Chicago Sun-Times*

Rubber-Concrete Flooring

Naugatuck Chemical Division, U States Rubber Co, has developed a concrete-type industrial flooring construction material that "gives" out cracking under heavy loads, d ens shock and noise, resists alkalie mild acids, is waterproof and h non-slip quality.

The material is a combinatio liquid rubber and a special cement der and is called Laticrete The ru content makes it so flexible when that a long, thin slab can be bent a circle by hand The rubber also the cured mix "bounce" and a bond that makes it resist breakc

under heavy use. Test patches in factories show virtually no wear after two years of high-volume traffic.

Laucrete comes in two parts — the powder and a liquid rubber—and is prepared like regular concrete.

Sees Through 7 Inches of Steel

A new inspection tool which makes use of radioactive cobalt 60 and is capable of radiographing — or "seeing through" — thickness of steel up to 7 inches, has been developed by The Babcock & Wilcox Co., Barberton, Ohio

The unit has been christened the "Isoscope" a derivation of the words "isotope," a radioactive material, and "scope," for the power to see through metals. The "Isoscope" which has been under study and development by B&W for the past 3 years, requires only one-third the exposure time of a million-volt X-ray unit, the announcement said, and paves the way for wider use of atomic energy in this application.

Speedy Fire-Detector Device

A new system utilizing an "electronic eye" for detecting fires at the speed of light, has been developed by Electronics Corp of America It is designed to protect airplane hangars, theaters, schools, churches, auditoriums warehouses, piers and cold-storage plants.

Each unit of the system, known as Fireye, has a 100-foot fire-detection coverage, or 5 times greater than the system previously used The new system's unique feature is that it "sees" fire in the infrared portion of the spectrum. The key to this achievement is a tiny, sensitive element, or electronic eye, which transmits an electrical signal when exposed to infrared radiation

The equipment required, according to ECA, is a simple device that includes a control panel set up on a wall, and one or more detectors in the ceiling.

An earlier electronic fire-detection system, ECA officials say, was developed by one of the corporation's predecessor companies about 4 years ago. Under that system, only 6 detectors could be used in a single area, each capable of protecting a maximum of 1,600 square feet. Now, according to Norman E. Carlson, ECA's Fireye Division industrial sales manager, the system can utilize as many as 20 detectors, each protecting an area up to 5,000 square feet.

Concerning the operation of the new system Carlson explains: "When a fire develops anywhere in an area protected by the electronic eye, the detector is actuated by the infrared radiation generated by the fire Instantly the control panel operates a relay system which either opens or closes a circuit. Results include: the ringing of a fire alarm bell or other warning signal to the local fire department, or immediate activation of an automatic fire extinguishing system."

Projection TV May Solve Color Problems

An experimental color-TV receiver that projects the image on a cabinet screen has been developed that might cut the cost of color sets and eliminate the problem of color purity

Three separate tubes are used in the device, each one to project a different hue These projection tubes individually would cost 1/15th as much as a tri-color tube used in present commercial models. There would also be a saving in maintenance, since if one tube fails only that one must be replaced.

The projection receiver would be housed in a shallow cabinet, and test models have produced a 240-square inch picture, W F Bailey and R.

Burr of the Hazeltine Corp, Little Neck, N. Y., told a meeting of the Institute of Radio Engineers.

The designers have also solved the problem of making the colors coincide on the screen and, since each of the tubes shines a separate color image on the screen, the color purity problem "simply does not exist," they said.

They called for a renewed study of projected color-TV in view of recent developments.

"Phantom Voice" for Automatic Elevators

An automatic elevator for department stores that announces the floors and wares to be obtained there, asks shoppers to step to the rear and admonishes those who block the doors is now being developed

The "phantom voice" for pushbutton elevators, to be recorded and synchronized with car movement, is a project of the Westinghouse Electric Corp.

The repertoire of this invisible voice will include: "This car up," "This car down," "Press your floor button, please," "Release the door, please," "Step to the back of the car, please," and a patter such as "Sixth floor—women's lingerie, house furnishings and china Step out, please."

Hidden loud-speakers in the car will take the place of the elevator operator's voice, just as pushbuttons have taken the place of his hand. The tape playback machine will be installed in the elevator machine room and connected by cables to the loud-speakers.

Flying Platform

Man's dreams of a personal flying carpet were partially fulfilled with the Navy's announcement that a one-man wingless platform had made short successful flights.

The circular platform, about as wi[illegible] as a man, is held in the air by a set [illegible] counter-rotating propellers hidden u[illegible]der the device, which suck air throu[illegible] holes in the platform

Designed and built by Hiller He[illegible]copters, Palo Alto, Calif., it has n[illegible] flown more than a few feet from t[illegible] ground. The revolutionary platform [illegible] stabilized and controlled by the sa[illegible] instinctive reactions a person uses [illegible] stand upright. The pilot just leans [illegible] the direction he wants to go

Further research and developme[illegible] will be necessary before these princip[illegible] can be applied in military aircraft

The device is covered at the side wi[illegible] a circular casing which protects t[illegible] pilot from the propeller blades. Fo[illegible] spherical legs support the flying pl[illegible]form on the ground.

The pilot stands inside a ring of met[illegible] about as high as his waist supported [illegible] 4 poles on the platform. Controls a[illegible] connected to this stand.

Two separate engines, which togeth[illegible] develop less than 100 horsepower, tu[illegible] the propellers —*Science Service*

Chart River Bottom with Electronic Depth-Sounder

"DE-119 Fathometer" is Raythe[illegible] Manufacturing Co.'s electronic dept[illegible] sounder, an instrument so small that [illegible] can be carried in a rowboat for char[illegible]ing the bottoms of rivers, lakes a[illegible] shoal waters. Built into a metal lu[illegible]gage-like case, the DE-119 weighs on[illegible] 40 lbs and is powered by a standa[illegible] 6-volt battery which will operate t[illegible] equipment for 8 hours. On the face [illegible] the case, a glass window reveals t[illegible] three-speed (12, 30 or 60 in. per hr[illegible] chart paper. The instrument is repor[illegible]ed as highly accurate over its ent[illegible] four-phase range from 0 to 240 f[illegible] depth. First phase covers depth of 0-[illegible]

ft.; the second 60-120; and the third and fourth cover the deep range.

Based on ultrasonic principles, the instrument generates a high frequency sound signal and then "listens" for its echo. The equipment converts the time interval automatically into a reading of feet or fathoms. Like all Fathometers, the company reports, the DE-119 is an effective fish finder, indicating the presence and location of schools of fish

—*Industrial Laboratories*

for the home

Back-Yard Bubbler

A "Back-Yard Bubbler" transforms any outdoor faucet into a convenient drinking fountain for hard-playing youngsters, gardeners, golfers or picnickers It screws directly on to the faucet. The fountain cup is made of durable noncorrodible material The tube is of green anodized hardened aluminum with stainless steel spring and nickel-plated fittings. It is sold by Empire Lion Sales Co., Brooklyn, N. Y.

Keeps Rugs Fresh and Clean

A chemical which can keep rugs and carpets, fabrics, painted walls, paper,

Du Pont Co.

"Ludox" colloidal silica, a product of Du Pont research is a soil-retardant It is commercially available for treatment of rugs, carpets, and upholstery materials by the manufacturer and in the home. Development work is continuing to bring applications for paper and painted surfaces to the market

"Ludox" does its work as a soil-retardant by filling up the microscopically small pits and crevices, known as soil receptor sites, that all surfaces possess in varying degree. Dirt particles become embedded in these sites, making them difficult or impossible to remove by ordinary methods. Once the tiny particles of silica fill the soil receptor sites, the dirt can literally find no place to go, and must remain on the surface, where it can be removed easily.

Particles of "Ludox" colloidal silica are so small that about 600 million of them would be required to cover the head of a pin Measured scientifically, each is about 17 millimicrons in diameter, or less than a millionth of an inch. Since the minimum soil particle diameter is about 20 millimicrons, "Ludox" can enter into any site receptive to soil.

The soil resistance of "Ludox" colloidal silica was demonstrated on rugs, upholstery material, wallpaper, painted surfaces, and other typical dust-collectors. The anti-soil solution, which is colorless, odorless, nonflammable and safe for home use, had previously been applied to portions of this material. The entire surface was then dusted heavily with ordinary house dirt sweepings After vacuuming, the treated area emerged clean, while the untreated portion was soiled severely The "Ludox" is not removed, however, by brushing or vacuum cleaning, but remains on the treated surface to give continued protection.

Plastic 3-Dimensional Wall Covering

A new, inexpensive, rigid vinyl dimensional wall covering, said to duplicate the natural beauty, form, color, and texture of bricks or stone is now available for consumer use. This mensional wall-covering can easily installed by the homeowner.

Called "Decro-Wall," the product is manufactured by the National Vacuum Molding Corp of Yonkers, N. Y. Made *of extremely light-weight fire-resistant* rigid vinyl, "Decro-Wall" is molded in 2 x 4 foot sheets, for easy installation on walls or panels in any room.

The manufacturer announces that "Decro-Wall" is available in 6 surfaces at present: Rough Textured Pattern and Dutch Rembrandt, both in White Brick; Dutch Rembrandt and Dutch Lilliput Small in Red Brick; Allegheny Cut Stone; and Ledge Rock.

Gas Air-Conditioners

Gas-powered air conditioners that will cost about two-thirds as much to run as electric ones will probably be on the market next year, it was disclosed at a meeting of the Southern Gas Assn

The device's motor is basically similar to that of an automobile, except that it uses gas as a fuel, Sheldon Coleman, president of the Coleman Co., Inc., Wichita, Kans , said.

If summer tests are favorable, the gas motor system will be on the market in limited quantities next season. Sharply increased production is expected for 1957.

Some of the characteristics of the air conditioner are

- Higher initial installed cost but this will be "more than offset" by very low operating cost
- The motor is designed to run for 10,000 hours, or the equivalent of 5 to 10 seasons, without major overhauling.
- It operates quietly.

Prefabricated Fireplace

A light and inexpensive fireplace, that also functions as a heating stove, has been invented.

It is designed to be installed on the floor of a house, without the need to reinforce or alter the house other t to provide openings for a chimney f Invented by John L. Gillen of I *wagiac, Mich , the prefabricated f* place has an inner metallic fire cha ber and smoke flue, and outer deco tive panels made of wood.

The ready-made, install-it-your fireplace received Patent No. 2,707,4 Mr. Gillen assigned the patent right Hearthplace, Inc., of Elkhart, Ind

Skid-Proof Flooring

Floors and stairways can now made skid-proof by covering them w a flexible, water-resistant sheet m rial made from irregularly shaped p ticles of synthetic resin used as grid material.

This protective device, the invent of *Gilbert G Willson, Jr , of St. P* Minn , was designed primarily for a craft-carrier flight decks The pr lems found here indicated the need an anti-skid flooring that was b abrasiveless and non-sparking, and, the same time, would not cut bare f nor wear out mops unduly fast

The safety flooring, which recei a patent, solves all these problems w the use of the pre-cured synth resins. These may replace the abras mineral particles now being used similar anti-skid coverings, Will claims He assigned the patent rig to the Minnesota Mining and Ma facturing Co. of St. Paul.

Kitchen Paint

A new kitchen paint is specially

ceilings. It is made by Sun Chem Corp , Long Island City, N. Y.

300 Times

than

An extraordinary carbohydrate, 300 times as sweet as conventional sugar, is getting an intensive going over by chemists at the National Institutes of Health. The compound is stevioside, obtained from a small shrub that grows wild in Paraguay. The crushed, dried leaves of this plant (known variously as the sweet herb of Paraguay, kaa he-e and *Stevia rebaudiana*) have for centuries been used by the natives to sweeten their bitter maté tea. As an unusual botanical feature, stevioside is present in the dried leaves in the exceptionally high concentration of 7 percent.

According to NIH's Hewitt G. Fletcher, Jr., the recent interest in this natural product is purely scientific. Certainly, producers of conventional

ing agents, has only limited appeal. For example, the growing of the Paraguayan plant is complicated by the fact that the seeds are usually sterile, and large-scale reproduction would require the use of cuttings.

Some years ago, Paraguayan growers, attempting to stir up commercial interest in this unusual crop, placed large areas under cultivation—only to have their hopes dashed when economic uses failed to materialize. Now, the plant is cultivated almost exclusively in private gardens as a botanical curiosity.

Of special scientific importance, stevioside is reportedly the sweetest natural substance known. —*Industrial and Engineering Chemistry*

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According to NIH's Hewitt G. Fletcher, Jr., the recent interest in this natural product is purely scientific. Certainly, producers of conventional sweetening agents need not become alarmed at the prospect of any sudden, severe commercial threat. Actually, stevioside is much too expensive, is far from easy to obtain, and, in view of the ready availability of other sweetening agents, has only limited appeal For example, the growing of the Paraguayan plant is complicated by the fact that the seeds are usually sterile, and large-scale reproduction would require the use of cuttings.

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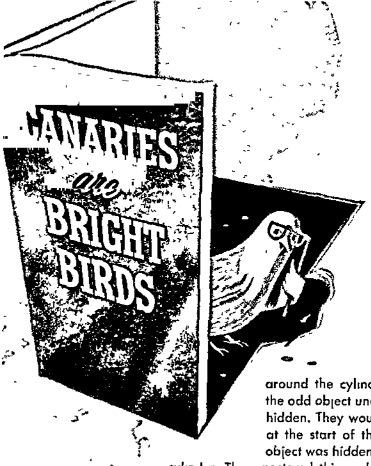

Canaries have
prised p-, ' ' -
with their intell
in tests at Queens
lege, Flushing, N. ·

Out of sight is
necessarily out
with these bright b'
Dr. Nicholas ,
told a meeting of
Eastern Psychologi
Association.

When 22 identi
objects and one
was different
equally spaced
a tall cylinder and
morsel of food wa
hidden under the
object, the 7 canar'
tested learned to f
around the cylinder until they came
the odd object under which the treat wa
hidden. They would do this even thoug
at the start of the experiment the
object was hidden from their view by th
cylinder. They mastered this problem in an average o
about 100 tries.

Another trick learned by the birds was even more re
markable This involved pulling a string-drawn "truck'
until it was alongside a bin holding a hoard of bird treats. To move th
truck, the bird had to tug on a string emerging through a hole in a
opaque screen that hid both truck and bin from him

First the bird was allowed a look at the truck to size up its distanc
from the bin. Then the canary went behind the screen and pulled th
string. Four different distances between truck and bin were used in th
experiment. Sometimes one tug would bring them abreast of eac
other. At other times it would take two, three or four tugs.

One bird learned to pull the required number of tugs and then ho
to the truck and perch on it to get his reward. Another bird learned th
problem but for only two different distances.

Two birds could not go through the experiment because they deve
oped fear of the whole situation. —*Science Service*

25¢

PACKAGED MOLECULES

A new method of preserving vitamins and other food products by wrapping each molecule separately is described by Dr. Hermann Schlenk of the University of Minnesota's Hormel Institute.

Vitamin A has been made "completely stable"—that is, resistant to deterioration for an indefinite time—by the technique, Dr. Schlenk reported.

The new process consists of crystallizing the vitamin in combination with another edible material to form an "inclusion compound" in which the crystalline structure of the other material encloses each molecule of vitamin in much the same way as an egg carton holds eggs.

Vitamin A is is an indispensable factor in human and animal nutrition, and its rapid deterioration during storage is a constant problem for the food-processing industry.

"This wrapping up of single molecules deserves more detailed explanation," Dr. Schlenk explains. "A good analogy is a carton of eggs as it is sold in grocery stores. Each egg is isolated in a single case. The eggs cannot kick each other; they can hardly roll around or even move. So long as the carton stands up against impact, the eggs are well protected.

"Take now, instead of the cardboard casing, a crystal structure similar to a honeycomb but much smaller, and take, instead of the eggs, the molecules of a vitamin. Then each molecule fits into one cell and is surrounded by a protective wall. It has little chance for contact with other molecules. The whole package may be bounced around, but the touchy vitamin molecules are as well protected as are the eggs in their carton."

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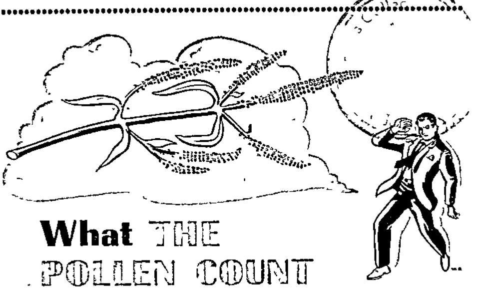


What THE POLLEN COUNT Means to You

by Oren C Durham

Condensed from Today's Health

THE DAILY POLLEN FIGURES appearing with the weather report in metropolitan newspapers are records, not predictions They are published along with weather records because of the profound influence of weather factors on the ripening and distribution of pollen grains and because, some years ago, weather observers in numerous cities helped allergists take daily pollen samples from the air. In no case, however, does the Weather Bureau analyze the samples; nor does it guarantee the accuracy of the published figures

In most cases the so-called "pollen count" is actually a ragweed-pollen record Though ragweed receives the lion's share of attention in most parts of the country, other kinds of pollen are by no means neglected. Many allergists, for their own information, take air samples every day from early spring until late fall, counting each kind of pollen separately and comparing their counts with local field observations In the mild climates of the South and Southwest, routine pollen counting is done every day of the year.

Although most wind-pollinated plants ripen and discharge the daily quota of pollen early in morning, the air is not heavily

Today's Health, 535 N Dearborn St, Chicago 10, Ill Copyright 1954 by The American Medical Association

taminated until 10 or 11 o'clock. For a while the little masses of yellow pollen cling lightly to open pollen cases, getting thoroughly dried and ready to be carried away when the plant is jostled by the wind. A large portion of all freshly ripened pollen falls to the ground within a few feet of the mother plant. The remainder, when caught up by the wind, is not merely suspended in the lower layer of air which we breathe, but is carried aloft by rising air currents.

On sunny summer days the uneven warming of the earth's surface produces warm air chimneys, or elevators, whose high tops are frequently marked by isolated fluffy cumulus clouds The level haze-line, which on clear days is distinctly visible from a plane, also coincides with the pollen ceiling. Sampling the air at various levels from airplanes has proved this. Below this haze-line, air turbulence holds the pollen grains, as well as smoke, dust and soot particles, in concentrations often as high as those near the ground—sometimes higher. By contrast, the overlying masses of cool air above the haze level are almost entirely free of pollen because they are quiet. The transition is frequently abrupt. The temporary suspension of pollen grains in turbulent air has been aptly compared to the suspension of mud in a bucket of water while the water is being vigorously stirred.

Pollen is never evenly distributed in the air, but is carried along in pollen clouds of greatly varying density. Concentrations measured 30 miles out over Lake Michigan have been found roughly three fourths as strong as concentrations at the same altitudes over land. On the other hand, large amounts of pollen have been deposited on decks of ships more than this distance out at sea

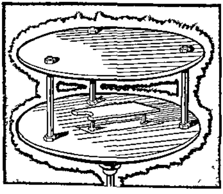
Routine pollen sampling as reported in the newspapers is not carried out by counting pollen grains recovered directly from measured volumes of air. Certainly this is the ideal method, but available technics and devices are far too inconvenient and expensive for the purposes of the allergist. So an indirect and less accurate method — the "gravity," or settling method — is nearly always used. Oiled glass slides (see picture, facing page) are exposed, oiled side up, for 24 hours outdoors. The place selected is usually the top of a tall building in the center of the city. Such a location is not ideal, but it minimizes the amount of pollen being blown directly from nearby plants to the slide. The pollen catch is examined under a microscope and a count is made of pollen grains on an area of one square centimeter From this count, the approximate average amount of pollen in a cubic yard of air during the whole time of the test can be calculated. The factors used in making this calculation have been worked out by long series of parallel tests comparing the gravity method results with actual volumetric tests.

Since the catch on a gravity slide is a total 24-hour deposit, it does not even suggest the hourly or momentary variations in the pollen count. Ordinarily the greatest concentra-

tions occur in the forenoon and the least after midnight. Moreover, not all of the pollen caught on these slides is deposited by gravity as it would be in still air; a large part of it is blown onto the slide by wind currents. So the windier the day, the more exaggerated the gravity count as compared with the actual degree of pollen in the air.

Different newspapers in the same city often publish quite different pollen count figures on the same day. This is not surprising considering all the variant factors involved In fact, it would be an accident if two observers sampling in different places came up with exactly the same result Obviously the daily pollen count cannot be an accurate index of the 24-hour pollen intake of any one person, for each person in his daily pursuits is likely to find himself in places of both greater and lesser exposure to pollen. A ride at high speeds in an open car can enormously increase his pollen intake, by thousands of grains per cubic yard of air; while time spent in an air-conditioned building may give him complete freedom from pollen One spot-test made in the middle of a public highway during a morning windstorm showed a momentary concentration of more than 9 million *ragweed grains per cubic yard of air.*

Routine pollen counting has been carried on and reported for no less than 600 cities, towns and recreational areas throughout North America, from Nome, Alaska, and St. Johns, Newfoundland, to Mexico City and the Virgin Islands Ragweed counts have been made in every one of these places throughout at least one ragweed season. In many places comprehensive counting of all pollens and even of air-borne fungus spores has been carried on for many consecutive seasons. In 1946, the Pollen Survey Committee, a part of the Research Council of the American Academy of Allergy, adopted a standard sampling device and counting unit, which greatly stimulated interest in pollen research not only by allergists but at universities and public health institutions. Everyone who uses the standard methods and reports regularly to the chairman of the Pollen Survey Committee, whether allergist, aerobiologist or botanist, is regarded as an active member of the Committee Comprehensive annual reports are prepared for wide distribution to allergists and other interested people. Graphs and tables of condensed pollen statistics have been incorporated in nearly



OILED GLASS SLIDES exposed for 24 hours trap pollen samples for accu counting. At least 600 cities in North America conduct pollen counts, many of them

every textbook on allergy written since 1925.

From the outset, these studies have made possible improvements in the diagnosis and treatment of hay fever and seasonal asthma. Thirty years ago only a few physicians in this country had any reliable information about the hay-fever weeds, grasses and trees — even those in their own localities. Since medical books had no authoritative information, each doctor confronted by a case of hay fever guessed at the season of pollen production and the relative importance of those plants which he supposed grew in his locality. His list of skin tests was unnecessarily long and usually included many species which were either far out of the range of the patient's contact or unimportant anywhere. Because the pollen problem has an essentially local nature, being influenced by local soil, weather and climate conditions, he could not gain much help from the clinical experience of physicians in areas far removed from his own.

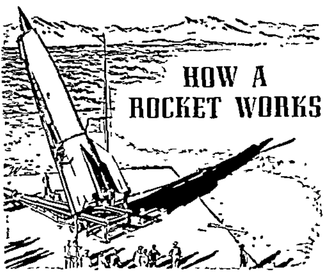
Now all this is changed Fewer tests are needed and more accurate diagnoses can be made. Skin reactions can be evaluated against the local calendar of pollination and the known volume of various local pollens. Proper timing of preseasonal preventive treatment is now easily determined, and the effect of palliative drugs can be checked against the fluctuations in the pollen count. If problems arise from unknown airborne allergens, sampling and counting can usually discover the offenders. Aerobiology offers a means of judging the effectiveness of weed-destruction campaigns in community efforts to reduce pollen hazards.

Until 1937 no comparative statistics on ragweed-free areas had been published. People who wished to escape the effect of ragweed had only the claims of local chambers of commerce and resort owners or the uncertain testimonials of those who had traveled about in search of hay-fever havens. Now the doctors can advise pollen sufferers where they can find relief by referring to the latest revision of the North American ragweed index, *Hay Fever Holiday.* This booklet is distributed by the Pollen Survey Committee, medical schools, departments of public health and travel agencies. Similar statistics, though not so complete, are available for other pollens.

First Radio Waves from Another Planet

Radio astronomers of the Carnegie Institution of Washington announced recently that they had detected intermittent radio waves coming from the planet Jupiter. This is the first recorded instance of such waves being received from a planet of our solar system.

The waves, which were observed through the Carnegie Institution's large radio "telescope" near Seneca, Maryland, were described as having the appearance of short random bursts of static resembling thunderstorm interference on a broadcast receiver.



HOW A ROCKET WORKS

by *Milton W. Rosen*

Condensed from a chapter of the book, The Viking Rocket Story

EVERY ROCKET ENGINEER has been asked at one time or another, "How does a rocket work?" Why should he find difficulty in answering what would appear to be the simplest question concerning his art? Perhaps the reason is that a rocket does work, and that everyone takes it for granted.

Some have likened a rocket to a gun; the bullet corresponds to the rocket's jet, and the gun's recoil to the forward push of the rocket. Then consider a machine gun which, if not fastened down, would inch backward as each bullet was ejected. Perhaps it is difficult to see each molecule of the rocket's jet as a bullet and to believe that it has a recoil on the rocket motor. A flame is such a tenuous thing that it is hard to see how it can push backward on the flame thrower, but it does, and in a large rocket it does so with a force measured in tons.

The jet pushes also on the air behind the motor, but this is not important; in fact, it serves only to slow up the jet and to decrease its recoil on the motor A rocket operates better in a vacuum and this is why it is the engine (indeed, the only one) that can propel a vehicle outside the atmosphere.

Perhaps a better analogy is found in a toy balloon If you blow up the balloon and pinch off the neck, there is inside a gas under pressure. The rubber skin stretches to resist this pressure, but the balloon doesn't go anywhere because the pressure is equal in all directions. Now, if you release the balloon, the gas issues forth from the neck, and the balloon scoots away in the opposite direction. This is rocket action.

In a sealed can containing a gas under pressure, nothing
we remove the right-hand
can, the gas streams out to

The Viking Rocket Story, copyright 1955 by Milton W Rosen and published at $3.75 by Harper & Brothers, 49 E 33rd St, New York 16, N Y

and the pressure on the left-hand end pushes the can to the left. Now we have a rocket. Next a nozzle is added. The nozzle makes the gas expand, and in doing so, the gas picks up speed. In a gun the faster the bullet, the harder the recoil.

What happens when the gas is exhausted? Of course, the motor stops. But suppose we can keep replenishing the gas by burning something in the motor—then the rocket will continue to operate.

Most engines which derive their power by burning a fuel require oxygen which they draw from the inexhaustible supply in the atmosphere. These engines are called air-breathing engines, and they include the internal combustion engines that drive automobiles and airplanes and also the turbojets that propel "jet" aircraft.

The rocket is in a class by itself because it carries its own oxygen, and hence can operate where there is no atmosphere.

Solid rocket fuels and a few liquids are mixtures which contain oxygen and hence can burn by themselves, but most liquid fuels, such as alcohol and gasoline, do not have oxygen, which must be supplied in another liquid, such as oxygen in liquid form. Hence most liquid-fueled rockets contain two liquids: a fuel and an oxidizer.

Since the burning fuels generate a pressure in the motor's combustion chamber, the liquids must be forced into the chamber against this pressure. In some rockets, high-pressure gas pushes the fuels out of their storage tanks. In this type of liquid rocket the storage tanks are under high pressure, and must be as rugged as the motor. The Aerobee, Wac Corporal, and many other rockets of relatively small size are pressure-fed liquid rockets.

Large rockets like the V-2 and Viking have been made possible by still another refinement: the use of turbine-driven pumps to force the liquids into the combustion chamber. The turbine is driven by steam obtained from a separate fuel—concentrated hydrogen peroxide. The liquid peroxide is converted in a steam generator into hot steam which is shot against the turbine blades. The main fuel tanks are at low pressure, just enough to feed the pumps, and hence are relatively thin-walled. This is why Viking can carry 80 percent of its gross weight in fuel.

Inside a liquid rocket's combustion chamber there is just about the *hottest flame generated* on this planet, atom bombs excepted. This heat can melt all metals and many ceramics, and it can be tolerated in a rocket only for a short time, a matter of seconds, unless there is some way of cooling the motor's walls.

A way was found almost simul-

MILTON W. ROSEN has been a staff member of the Naval Research Laboratory since 1940, and since 1947 has been the scientific officer in charge of development of the Viking rocket used to explore the upper atmosphere. He has developed a radar relay system for aircraft and radio-control systems for guided missiles. He is chairman of the Space Flight Committee of the American Rocket Society.

taneously in America and in Germany, in the 1930's—in America the invention is credited to James Wyld, formerly of Reaction Motors, Inc.

The regenerative motor, as Wyld called it, has a jacket which completely surrounds the motor chamber and nozzle, making it a double-walled vessel. One of the fuels, forced through the jacket before it enters the combustion chamber, absorbs all the heat that the flame transfers to the inner wall, or liner.

You can imagine how delicate a balance must exist between the heat generated and that absorbed At the California Institute of Technology I once saw a test-firing in which a small tongue broke through the chamber wall, cut the rocket in half in less than a second, and sent the nozzle flying out of the pit.

Nevertheless, this heat balance is maintained day after day in thousands of liquid rockets; so much so, that a man could put his hand on the outer wall while a 5000 degree Fahrenheit flame was roaring inside less than an inch away I would not advise it, even though Lovell Lawrence, when he was president of Reaction Motors, often boasted that he would be willing to sit on one of his company's products while it was actually firing

The sight and the sound of a rocket test-firing, in which the motor is firmly secured, is better experienced than described. The spearlike flame extends from the nozzle many times the length of the motor—the Viking flame is 40 feet long. Often there are bright luminous diamonds in the jet—shock waves created by the supersonic speed of the hot, burning gas

The sound is almost unbearable, even to men who fire rockets day after day. A small rocket, one that a man could hold in his palm, emits a shrill, piercing sound. In the large ones the sound is overwhelming, like the lowest note of a pipe organ magnified a thousand times

But there is more than light and sound; there is vibration, which one can feel at several hundred feet distance — and all combine in a fury that seems to tear at one's inner organs.

Perhaps the most novel feature of Viking, certainly the one that has attracted the most attention, is its gimbaled motor, which steers and stabilizes the massive airframe The rocket motor which propels Viking with a 10-ton push is mounted so that it can swing in two crossing directions. The member which holds the motor and allows it to swing is doughnut shaped and is called a gimbal The motor is attached to the gimbal through two bearings, and the gimbal, in turn, to the rocket's shell by two more bearings.

Two piston-type actuators — one between the gimbal and the motor, the other between the gimbal and the shell—provide the forces that push the motor in either or both of two directions, called pitch and yaw. In some Viking flights the motor motion has been very prominent, rocket has appeared as of fantastic animal fiery tail.

It may well be asked why it was necessary to contrive such a complicated arrangement for steering a rocket intended to go only straight up. The answer is that the forces of nature conspire to turn a rocket away from its desired course, and this situation must either be accepted or resisted.

Ideally, in still air, a rocket should fly a straight line by virtue of its fins, if the fins are accurately aligned. But there are winds and gusts to contend with. Moreover, Viking encounters two conditions where the air gives no assistance—one, at launching, when the rocket's forward speed is too low, and the other near the end of its powered flight, when it is above the sensible atmosphere, as high as 158 miles.

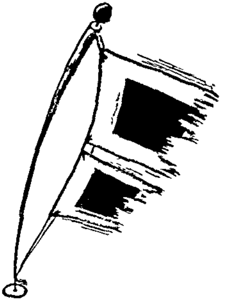
A rocket, and for that matter any vehicle that travels through a fluid, such as a ship or airplane, can have three distinct turning motions called pitch, yaw, and roll. These turning motions can and do change the direction of the vehicle's forward motion. If the turning influences are wholly outside the vehicle, then it is unguided; if the vehicle attempts to generate or to control those forces, then it is steered. A bullet is unguided, an airplane is steered. An airplane pitches when its nose goes up or down; when it yaws its nose goes from side to side, and in a roll its wings flop over. A rocket has the same turning motions except that they refer to a vertical flight path rather than a level one as in an airplane.

The problem of steering Viking is, in principle at least, remarkably simple—the rocket is to fly a straight line nearly vertical, and the steering system is required to resist and to correct all motions in pitch, yaw, or roll. These motions are called errors, and in order to correct an error designers and engineers must know that it exists.

In an airplane, the pilot watches his automatic horizon for pitch and roll, and his compass for yaw. When he sees an error, the pilot moves rudder, elevators, or ailerons as necessary. Some planes have an automatic pilot which both senses the errors and moves the control surfaces.

In a rocket an automatic pilot is a necessity — the rocket does not carry a human pilot, and even if it did, no human could respond with enough speed and precision to manage the controls. With Viking's tremendous forces in his hands, a human pilot could not help flying a wild course.

The basic instrument of most autopilots is a gyroscope, which has the happy property, like a spinning top, of always pointing in the same direction. In Viking a gyroscope points upward (actually three degrees from the vertical), and the rocket tries to fly in the constant direction indicated by the gyroscope. When the rocket departs from this direction, the gyroscope detects the error and sends orders to the gimbaled motor to return the rocket to the correct heading. The gyroscope is the rocket's brain, the gimbaled motor its muscle.



Can We Control HURRICANES?

by Raymond Schuessler

It was hurricane time in the tropical waters of the Caribbean and as we headed our little fishing boat back to Puerto Rico, we cursed our stupidity in staying out too long.

No one spoke as we kept anxious eyes across the glassy-smooth sea now pregnant with danger, heaving gently under the relentless sun.

Suddenly, the sluggish water was turned to vapor by the boiling sun. We saw the vapor swirl upward like a magi's incense—a warm air current weighted with the sea. Another, and then another column of water-bearing air formed in the updraft. Suddenly the whirling columns flowed together and merged into a great mass and we felt the air being sucked from our lungs by this weird chemistry of the sea The sea began to rock and foam We threw the motors wide open and prayed.

We had actually witnessed the birth of a hurricane! But would we live to tell about it?

As we moved away the bigger column sucked in hot air from all sides and mounted higher and higher, until at 30,000 feet or more it probably reached a ceiling of cold air Mushrooming against the layer of cold air, the warm air become chilled and dropped its load of moisture upon us Luckily we were moving out of it at the time It was a race against death, and we had won

Within a few hours we could see in the distance the dark, ominous mass of whirling water, wind, and clouds spinning like a top along a 10-mile base. Scientifically, the rotating force of the earth had seized the column of air and rain and spun it in a northerly direction As it moved it grew. Soon it would encompass 300 miles of whirling fury.

Our first concern was to send a warning to the U. S weather station at Miami But this already had been done. Freighters in the area days before had wired to Miami about suspiciously low barometric pressures, and the famed Hurricane Hunter Squadron was in the area.

Ships were scurrying from the hurricane's path. The people were ma ing ready by boarding up their dows and staying off the This is all we can do to hurricane

We cannot prevent it, nor contain it yet, but by greater knowledge of its habits and making ready for its coming we can nullify a great deal of its power. With the airplane, radar and radio, this is being done.

Up until last year we believed that hurricanes continued to grow only while over the ocean, since a large land area cuts off the supply of heat energy and interferes with the spiral inflow of air at the base. But when Hurricane Hazel tore into Toronto last year, 500 miles inland, at full force, we learned something new: hurricanes are influenced by surrounding weather conditions, which affect their course.

The reason Hazel did not lose any of her force was that the hurricane, which usually travels 15 to 25 miles per hour, hit a low-pressure trough in the upper air which sucked the hurricane north at a speed of 50 miles per hour. This is forward speed, not spiral speed

The Weather Bureau had watched the trough approach the coast from the west as Hazel approached it from the southeast. But the Bureau had no way of determining if the two would meet. This year during the hurricane season the entire eastern part of the continent will watch carefully all local and surrounding weather conditions.

There is only one way to get advance warning of a hurricane; that is to send out planes to discover and track these storms in their incubation lair—the Caribbean from June to November. This is the job of the Hurricane Hunters, one of the toughest non-combat flying assignments in the world.

The first reports usually come from ships in the Caribbean. A plane immediately takes off and radios back messages on direction and velocity. The plane must actually fly into the brunt of the hurricane, where winds may reach 150 miles per hour in spiral speed.

"It's a beautiful but bruising experience," says Capt. Augsburger of the Hurricane Warning Center in Miami.

"The eye of a hurricane is like nothing else in the world. You can't believe it until you see it. It's like a huge amphitheatre. Around you is a solid wall of clouds. The sky above is clear blue; the sea is as calm as a lake in Central Park. You could row a canoe in it."

Strange things go on in the eye of a hurricane. Small freighters have been known to fight their way to these centers and, in the calm waters, ride out the most violent storms. A plane crew once sighted a tiny fishing vessel whose crew was sunbathing on deck.

But on the ring of the eye, mountainous seas explode into snowy foam and winds roar to 120 miles per hour. Rainfall during the peak of the storm is like walking under Niagara Falls, as billions of tons of water sucked up from the sea are released.

"The plane itself takes a terrific beating," says Capt. Augsburger. "We have to sample three sides of the storm. It's a real strong job to hold the bucking plane on a compass reading. Sometimes a downdraft will

spill us 700 feet in a few seconds. The pull is so terrific you can't get your head off your chest. It's hard to breathe, your ribs ache where the safety-belt tears, your stomach is in your throat, your clothing is soaked with sweat."

As dangerous as the job is, hurricanes must be tracked and trailed in order to save lives and property. With a 24-hour notice much of their fury can be combated. The 1928 Florida hurricane killed 1,800 people. In 1948 the same type of storm hit the same section with equal fury. This time with adequate warning the community buttoned up and only 2 lives were lost. The Miami storm of equal intensity struck a vastly enlarged Miami, but with 30 hours' time to get ready, damages were cut to $14 million.

• I live in a time that is bewildered by scientific fact, and yet it knows that no faith will again satisfy it which does not embrace the truth of science.
—J. Bronowski

The cause of a hurricane is not exactly known. There are two theories. According to the "convectional" idea, a large mass of warm air rises. Then sea-level air rushes into the vacuum left by the rising warm air. The rotation of the earth deflects the moving mass into a counter-clockwise whirl north of the Equator, clockwise south of it. A vigorous wind system is set up. The other theory, the "counter-current" scheme, has it that opposing trade winds, warm and cold, cause the initial air lift.

In either case, the whirling storm is nuzzled by the trade winds from the doldrums (an equatorial region of calms), just off the South American north coast, across the West Indies toward Florida. No one knows why the spiraling air mass doesn't slow down. A big hurricane can use up enough energy to power the world's machinery for four years. Some estimate it has the force of 400 exploding A-bombs.

The greatest loss of life from disaster in the history of North America occurred during the Texas-Louisiana hurricane of 1900 which killed 8,000 people in Galveston alone as a tidal wave swept over the Texas town, inundating streets to 16 feet.

Yet the 90-miles-per-hour winds in this storm were by no means exceptional among the more than 200 hurricanes which have hit the continent in the last 90 years In the hurricane which ripped across New England in 1938, wind velocities reached 150 miles per hour In some Florida blows, winds have been estimated as high as 250

Florida's worst disaster in point of lives lost was in 1928, when a hurricane swept across Palm Beach, traveled inland and scooped billions of gallons of water from Lake Okeechobee, drowning 1,800 people who lived south of the lake.

But nothing in this part of the world can compare with some of th Far East storms. In 1876 more t 100,000 people drowned in the of Bengal, while at the same century earlier, history's rible typhoon hit the India

(Hurricanes in India and China are called typhoons.) A tidal wave of 40 feet rose out of the sea, sinking 20,000 boats and taking the lives of 300,000 people!

Can we see the day when men can stop hurricanes? "Not in the foreseeable future," says Miami's new hurricane expert, Gordon Dunn. "Some years ago the Navy dry-iced a hurricane. It didn't break up but it did act peculiar.

"I just got another idea from an inventor. He suggests vaned funnel-shaped drums carried into the hurricanes by planes and dropped, one in each quadrant of the storm. His idea is that the drums will set up counter-currents of air that will break up a hurricane. Like most inventors who send us ideas, however, this man doesn't visualize how fantastically large the area of a hurricane is. A full-blown hurricane may be 500 miles in diameter. Forces involved are immense "

Hurricane fighting has been improved this year. Miami has a new super-radar set for tracking hurricanes. It is one of five very powerful sets reaching almost 100 miles further than the old ones. The others are located at Hatteras, Wilmington, Nantucket and San Juan. These are the most important tools in hurricane forecasting.

The Navy also has a ring of seismograph stations around the Gulf of Mexico and the Caribbean to study earth tremors caused by hurricanes The enormous amount of energy released over the sea by a hurricane causes vibrations which are transmitted through the water to land where they can be detected by these sensitive earthquake instruments

"There are many things to be learned about hurricanes," says Gordon Dunn, "First of all we have to find out why they wobble back and forth across the line of their general direction, and how we can foretell when and where they will wobble. We hope to do so this year."

A great deal of pressure has been brought to bear against calling the hurricanes by feminine names. But the practice will be continued. "Hurricanes are like women," says Dunn, "Each has a personality with caprices and whims all its own. They may turn anywhere like a woman driver with her hand out the window. But no hurricane acts like a lady. They're always vicious."

Politicians who object to the idea, Mr. Dunn says, should be informed that the practice of naming hurricanes began with an Australian weatherman. "He named each storm after a politician he didn't like. The biggest storms were named for the politicians he considered the biggest scoundrels."

CENTURIES AGO, asbestos was known as live flax It was woven for napkins and handkerchiefs. A soiled handkerchief was not washed but was thrown into a flame The soil was burned off and the cloth came out "sterilized" and white.

PROTEIN key to life

by *Isaac Asimov, Ph D.*
Assistant Professor of Biochemistry, Boston University School of Medicine

Condensed from the book, The Chemicals of Life

IN EVERY PART of the body, there is a type of substance called protein. Some parts of the body contain more than others. Blood and muscles are $\frac{1}{5}$th protein, brain is $\frac{1}{12}$th protein, tooth enamel is less than $\frac{1}{100}$th protein. The point is that no living portion of the body is completely without protein.

This holds true not only for human beings, but for all plants and animals. There is no life at all, of any kind, in the absence of protein. Even if we consider very small and simple form of life, such as bacteria, we find protein. If we probe deeper still, to the very simplest objects we can call alive, the viruses, we still find protein.

Viruses are so small that bacteria are giants in comparison. Some are so small that it would take a million in a row to make a line one inch long. They are so small that they have given up almost all the functions of life, except the ability to multiply. They do this inside the living cells of other creatures, and in the process frequently cause disease. Measles, infantile paralysis, and the common cold are examples of diseases caused by virus multiplication in the cells of human beings

The smallest viruses seem to be composed only of chemicals that are absolutely necessary to life. They have no room for non-essentials It is important to note, therefore, that such viruses are composed of nothing more than a particularly complicated kind of protein called nucleoprotein. Here, it would seem, we have gotten down to pure life without any trimmings at all, and it protein.

When protein was first iso from living tissue about 120

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ago, scientists realized almost at once that it was something quite special. Even its name shows that. A Dutch biochemist, named Mulder, who first used the word "protein" back in 1838, got it from a Greek word meaning "holding first place."

Protein, in all its many varieties, certainly does that, as far as life is concerned.

What are proteins made of? They are made of atoms, and so are the rocks, the stars and in fact everything.

The chemist has given a different name to each variety of atom, and the different varieties are called elements. Altogether, 100 different elements are known today. Some elements, like gold, silver, iron, and copper, are familiar to all of us; others are so unusual that very few people have heard of them.

Atoms rarely occur by themselves. They seem to prefer to exist as groups of varying size. Such a group of atoms is called a molecule.

Coming back to proteins, what makes proteins so unusual? Well, for one thing, the protein molecule is very large. To show what we mean, let's consider the weight of different kinds of atoms and molecules.

Naturally, all atoms are exceedingly light. It takes billions upon billions of them to make up the weight of even the tiniest particle of dust. It is one of the miracles of science that man has weighed atoms despite their minuteness.

Now it turns out that the hydrogen atom is the lightest one that can exist and it is customary to call its weight 1 for convenience. Or, to put it just a little more scientifically, 1 is called the atomic weight of hydrogen. The carbon atom is 12 times as heavy as the hydrogen atom and carbon's atomic weight is therefore 12. In the same way, we can say that the atomic weight of nitrogen is 14, of oxygen is 16, and of sulfur is 32.

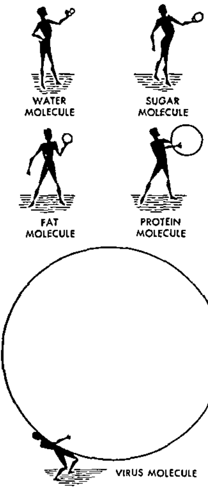
In order to find out how much a molecule weighs, it is only necessary to add up the atomic weights of the atoms it contains. For instance, the hydrogen molecule consists of two hydrogen atoms, each with an atomic weight of 1. The molecular weight of hydrogen is therefore 2. Similarly, the nitrogen molecule is made up of two nitrogen atoms which weigh 14 each. The oxygen molecule is made up of two oxygen atoms which weigh 16 each. The molecular weight of nitrogen is therefore 28 and that of oxygen is 32.

The same rule holds where the atoms in a molecule are of different types. The water molecule, with one oxygen and two hydrogen atoms, has a molecular weight of 16 plus 1 plus 1, or 18.

The water molecule is a rather small one. A molecule of table sugar, by contrast, has 12 carbon atoms, 22 hydrogen atoms and 11 oxygen atoms. The 12 carbons weigh 144

ISAAC ASIMOV is a man of many talents. He possesses a B.A., M.A., and Ph.D., all from Columbia University, and is now

SIZES OF MOLECULES



altogether, the 22 hydrogen weigh 22, and the 11 oxygen weigh 176. Add them all together and the molecular weight of sugar turns out to be 342. This is a more sizable figure than that for water, but it is by no means tops. A molecule of a typical fat contains as many as 170 atoms; its molecular weight is nearly 900.

Now we are ready to consider the protein molecule. How does it compare with fat and sugar in this respect? Of course, there are innumerable different kinds of protein molecules, but we can pick a protein that occurs in milk and has been studied quite a bit. In its molecule are no less than 5,941 atoms. Of these, 1,864 are carbon, 3,012 are hydrogen, 576 are oxygen, 468 are nitrogen and 21 are sulfur. The molecular weight is quite large. It comes to a little over 40,000 The molecule of this protein is about 45 times as large as a molecule of fat and 120 times as large as one of sugar

But is this protein a fair example? Actually, it is not, because it is a rather small protein The average protein has a molecular weight of 60,000. Many go much higher Some of the proteins in clam-blood, for instance, have a molecular weight of 4 million. And some of the viruses consist of protein molecules with molecular weights in the tens of millions; even hundreds of millions

Now size in itself can be very useful. The body can do things with a protein molecule that it could not do with smaller molecules It is as though you were given the choice of having a birthday party in the large ballroom of an expensive hotel or in a little one-room tenement flat. Obviously the ballroom would have many more possibilities (provided money were no object).

But is size alone enough? could imagine a large ballroo no furniture and no ventila might then be preferable to birthday party in the sm

Actually, there are molecules that are just as large as proteins but that are nevertheless much more limited in their usefulness than proteins. For instance, the chief compound of ordinary wood is cellulose. Its molecule is very large but its only use to the plant is as a stiffening substance in the walls around the living plant cells. Again, the starch-like substance called glycogen, that occurs in animal livers, has a large molecule and yet is used only as a body fuel. Proteins, on the other hand, have millions and billions of different functions in the body.

Why is this so? Well, the key to the mystery can be found if cellulose or glycogen are treated with certain acids. These acids cause the cellulose or glycogen molecule to break up into smaller pieces. The smaller pieces turn out to be the same in both cases. They are molecules of glucose, a kind of sugar which is found in blood and which is somewhat simpler than ordinary table sugar.

The cellulose molecule, in other words, seems to resemble a necklace made up of thousands of individual glucose molecules strung together like so many beads. The glycogen molecule is made up of these same glucose molecules strung together in a different pattern.

Apparently, the fact that cellulose and glycogen are made up of only one type of smaller molecule limits their versatility. This also holds true for other such giant molecules (with the exception of proteins) which almost always consist of only one (or sometimes two) sub-units.

It is as though you were given the job of making up a language but were only allowed to use a single letter. You could have words like *aa* and *aaaa*, and *aaaaaaaaaaaaaa*. In fact, you could have any number of words, depending on how many *a*'s you wished to string together, but it wouldn't be a satisfactory language. Things would be a little better if you were allowed to use 2 letters; still better if allowed to use 3; and very much better if allowed to use 20

The last is exactly the case in proteins. When proteins are exposed to acid, their molecules also break apart into a number of smaller molecules. These smaller molecules are known as amino-acids, and they are not all the same. There are about 20 different amino-acids, varying in size from a molecular weight of 90 to one of about 250 They can be strung together to form proteins in every which way. And each time they are strung together in a slightly different way, they make a slightly different protein.

How many different combinations are there possible in a protein molecule? Well, an average protein molecule would contain about 500 amino-acid molecules, altogether, but we can start with a much smaller number. Suppose we start with only two different amino-acids and call them *a* and *b*. They can be arranged in two different ways: *ab* and *ba*. If we had three different amino-acids, *a*, *b*, and *c*, we could make six combinations: *abc*, *acb*, *bac*, *bca*, *cab*, and *cba*. With four different amino-acids, we could make 24 combinations.

However, the number of possible arrangements shoots up very sharply as the number of amino-acids is increased. By the time you get to 10 different amino-acids, there are more than 3,500,000 possibilities and with 20 amino-acids, almost 2,500,000,000,000,000,000 arrangements. (This seems unbelievable, but it is so. If the reader is doubtful, let him try listing the different arrangements for only 6 amino-acids. He will probably give up long before he has run out of arrangements.)

In the case of our average protein with 500 amino-acids, even though the 500 are not all different, the number of possible arrangements is so large that it can only be expressed by a 1 followed by 600 zeros. This is a far, far greater number than the number of all the atoms in the universe. You may understand why this should be if you will imagine taking the 26 letters of the alphabet and counting the number of words you can make out of them. Not only the real words, but words with any number of letters up to 500, and especially including all the unpronounceable ones.

Remember that each one of these amino-acid arrangements is a slightly different protein. It is no wonder, then, that the body can design different proteins to accomplish different tasks without any danger of ever running out of new varieties. No wonder, too, that out of a molecule such as this, life can be built.

Wonder Drugs Save 1,500,000 Lives

About 1½ million lives were saved in the first 15 years of the sulfa-drug antibiotic era, says Dr. C C. Dauer, medical adviser in the National Office of Vital Statistics, Public Health Service.

The lives saved represent those who might have died if death rates from certain infectious diseases had gone down at the same rate after 1937 as they had in the preceding years That year, 1937, marks the first in which a sulfa drug *became generally used in the U S.*

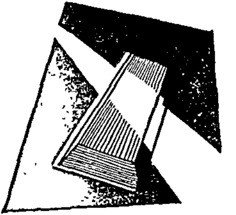
Nearly three-fourths, or 1,100,000, of the lives saved during that period (1938-1952 inclusive) would have been lost to pneumonia and influenza.

The 1½-million figure does not include a substantial number of deaths prevented from tuberculosis and some other infectious diseases which have also responded favorably to antibiotics and chemical remedies It does include, besides pneumonia and influenza, streptococcal infections, puerperal sepsis,

saved from death through
fever, or infection Lives
syphilis death during the
about 136,000 and those
citis 90,000

SUPER-PURE METALS

by Joseph B. Kushner



THE Bell Telephone metallurgists were admittedly stumped. What was the mystery stuff in Chuquicamata copper that gave it such remarkable electrical properties? For some unfathomed reason, copper mined in this region of Chile was hands-down superior to copper from every other part of the world when it came to making instruments which juggled the current on their long distance lines.

The metallurgists were certain a strange substance in the copper made it behave the way it did, but for the life of them they could not find out what it was.

First they tried chemical tests so sensitive they could literally detect the proverbial needle in a haystack—but soon found themselves up a blind alley. They could discover nothing in the Chuquicamata copper that wasn't present in ordinary copper from a hundred and one other mining areas. Then they knew what they were up against. They were playing a game of hide and seek with atomic ghosts — sometimes called "trace" elements.

Determined to lick the problem, they turned to that chemical court of last resort, the mass spectrograph. The mass spectrograph is a complex, ultra-sensitive atom detective that sorts atoms according to their weight. Feed it a millionth of an ounce of an unknown substance and it will come up with a picture that not only tells what was in the sample but in what amounts as well!

Copper samples went in—not once —not twice—but many times. The pictures showed nothing different. Obviously, whatever it was that was present in the Chuquicamata copper was present in such an infinitesimal amount as to be beyond the reach of any known method of analysis. The metallurgists realized that the only hope of putting the finger on the mystery atoms was to concentrate them in some way until there were enough of them to give a positive reaction in the spectrograph. Unfortunately, they knew of no way to do it. So they filed this chemical doozer under "temporarily unsolved."

They did not know that in another laboratory in the same building another team of scientists supposedly working on another project was in actuality working the opposite side of the street on what was basically the same problem.

This team, a group of physicists

under the direction of Alvin Shockley, was busy developing transistors, miracle bits of metal the size of match heads that are now replacing vacuum tubes in many places. The metal used in these transistors, germanium, had to be extremely pure, in fact, just about absolutely pure, for the transistors to work their electronic legerdemain. Just a few of the wrong atoms floating around in this strange metal on the borderline between an electrical conductor and an insulator, could make the difference between good results and bad. The question was, how could the germanium be made "absolutely pure" on a production basis?

Unhappily, no matter what the advertisements say, nothing in this universe is absolutely pure We can

Now it isn't too hard to refine a metal to 99.99-percent purity, which means there is something else beside the metal present to the extent of 1 part in 10,000—but once you get beyond this point the going gets rough! For every 9 you stick on behind the decimal point after the first two 9's, the cost increases 10-fold, sometimes 100-fold The reason for this is that involved, delicate and time-consuming crystallization operations are required, so that the final product becomes more precious than gold. The transistor physicists were not asking for too much in the way of purity. They were only asking for germanium 99.9999 percent pure!

The task seemed well-nigh hopeless and Earl Schumacher, chief metallurgist, in whose lap this little problem was dropped, was ready to admit it. In a talk before the American Institute of Metallurgical Engineers, he ended on this rather discouraged note: "Perhaps some day we shall be privileged to study the properties of really pure metals The first problem is to secure them "

He had no inkling then, that less than three years later, a remarkable invention by one of his own laboratory confreres would throw a completely new light on the subject That invention, called *zone refining* by its discoverer—lean, bespectacled metallurgist Walter Pfann — promises to be one of the outstanding developments in the history of man's search for absolute purity. With it it has been possible to produce germanium of such fantastic purity that even to see it symbolized on paper is unbelievable!

The purity achieved can be written as 99 99999999 percent, which is the equivalent of 1 part of impurity in 10 billion parts of metal Figures of this magnitude are incomprehensible even to mathematicians but some idea of how ultra-pure the germanium is can be gained from this comparison: If we had 35 freight cars loaded with the metal we would find just about one teaspoon of purity in the whole lot!

JOSEPH B KUSHNER, a metallurgical and chemical engineer, is director of an electroplating school in Stroudsburg, Pa He has written articles on electroplating for a number of technical and trade journals

Like all great inventions, zone refining is based on a very simple principle. Most troublesome impurities are usually soluble in the "host" metal, the way salt is in water. And most impurities are a bit choosy in this connection; they prefer their host in the liquid state rather than in the solid state. The principle is readily illustrated by sea water. You can't drink the stuff because it is so loaded with salt. Yet in the polar regions where the sea water has frozen to ice, you can melt the ice and get fairly potable drinking-water. The reason for this is that the salt dissolves more readily in water than it does in ice, so when the sea water freezes, most of the salt stays in the part that didn't freeze.

• Scientific development, particularly new basic discoveries, requires complete freedom for the scientist to pursue his own curiosities. It is only for the practical application of basic principles which have already been established that science can be blueprinted.

—Franz Alexander, M. D.

A similar thing happens when an impure metal is solidified from the molten state. The soluble impurities tend to congregate wherever the metal is still liquid. For this reason, a long molten ingot of metal, if cooled from one end will be found to be very pure at the cool end and very impure in the part that cooled last. In the metal trades this is known as segregation and many precautions are taken to prevent it. Dr. Pfann did exactly the reverse. He encouraged it!

In his process he has a long bar or ingot of commercially pure metal resting in a ceramic boat. The boat rides a track inside a long quartz tube. Outside and surrounding the tube is a two-turn coil of copper wire carrying a high-frequency electrical current. As the boat moves on the track and the front end of the ingot passes the coil the heat induced from the narrow electric field causes a narrow zone in the passing metal to become liquid. This thin liquid zone moves along the metal as the bar moves through the tube.

Starting with the left end of the bar which hits the coil first, any impurities in that part congregate in the first molten zone. Now as the molten zone moves a little to the right the very front tip of the bar freezes. The impurities, preferring the liquid state, hang on to the molten zone and move along with it. Thus there is a sort of atomic sweeping action along the bar, the impurities being swept along over to the last part of the ingot.

This is called the *first pass* in the purification process. If the whole procedure is repeated with the ingot traveling in the same direction as before, any contaminants that were left behind the first time are swept back to the right end. By repeating the process a number of times we can refine the ingot to almost any degree of purity. When this condition has been reached, the ingot is removed and the right end, containing all the trapped impurities, is cropped off.

The number of times the metal bar has to be passed in order to achieve a definite degree of purity

will depend primarily on the solubility preference of the contaminant being cleaned out of the metal. If, for example, the impurity is 10 times more soluble in the liquid metal than it is in the solid metal, after the first pass, 1/10th of the original impurity content will be left in the front end of the bar. After the second pass 1/100th will be left, and so on.

Of course, there are limits to everything and this refining process has its limits too. As the harmful atoms are swept back to the end of the bar they start piling up so high there that some of them start sliding back a little. Soon a point is reached where just as much slides back as is swept in by the molten zone and when this occurs the ultimate purity limit has been reached. It turns out for the case described in the previous paragraph, that the maxium purity that can be arrived at at the front end of the bar is 99.999999999999 percent!

The zone refiner as originally conceived by Dr. Pfann a short three years ago is already considered primitive in the light of recent developments in the process. One of the first improvements made was to use several high-frequency coils around the quartz tube instead of just one. This automatically cuts the number of passes required to obtain pure metal by as much as ten times or more. Thus if there are ten coils producing ten atom-scavenging molten zones in the metal bar as it passes through the tube, it is the equivalent of passing the bar through a single coil ten times!

Perhaps the greatest and most unique development in this astonishing process is one announced by Dr. Pfann a few months ago. The original zone refining process is a batch process. Everything has to be done piecemeal. Metal cannot be purified continuously. This was the one great drawback to really large-scale production of pure metals. With one stroke this drawback has now been demolished. His new invention, based on the basic zone refining method, which he calls "continuous multi-stage zone refining" makes it possible to get pure metal in a continuous flow!

Just as in a still used for separating alcohol from water, molten metal is fed to the system continuously. In one column, the metal is stripped of its impurities and comes out refined to the *n*th degree, by the moving molten zones. From a second column, highly impure metal comes out rich in the contaminating atoms. Raw commercial metal is fed to the melting pot of the apparatus continuously and pure refined metal is produced continuously!

The future of this astonishing zone refining process appears to be unbounded More and more it is being realized in chemistry and metallurgy today that trace elements have enormously potent effects. For example, iron that is really pure has a strength 100 times as great as commercially pure iron Molybdenum, a strange metal which has remarkable st... at high temperatures becomes... lessly brittle at room temp... it is contaminated with as

amount as .0005 percent of oxygen.

Titanium, the metal of the future, which is almost as strong as structural steel and as light as aluminum, fails miserably if it is contaminated with as little as .02 of a percent of hydrogen. Certain magnetic alloys containing .0018 percent of nitrogen have their magnetic strength increased by as much as 30 times, if the nitrogen content is reduced to .0001 percent. Any number of such believe-it-or-not examples of the little meaning a lot can be given. Accordingly, the zone refining process holds forth the promise of better, stronger metals with perhaps undreamed of properties, and new developments in metal physics which will make even the miraculous transistor of today obsolete.

Oh yes, about that Chuquicamata copper. The Bell Telephone scientists, by working the zone refining process in reverse (they were interested in the impurity and not the pure copper) succeeded in concentrating the contaminants in the copper to such an extent that they were finally able to put the finger on the culprit atoms. They are now busily investigating these complex ghost atoms to see what new electronic magic can be cooked up with them.

Work Begun on First Transatlantic Phone Cable

Laying of the world's first transoceanic telephone cable, to link North America and Europe, got under way in [illegible]

The 2,372-mile underwater cable will cover the 2,250 miles between that point and Oban, Scotland The extra length is needed because the cable will follow the ocean's mountainous floor, at some points more than three miles below the surface.

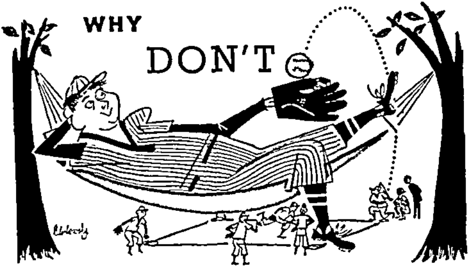
Transatlantic telephone calls today are transmitted by bouncing radio signals off the ionosphere. Such beams carry about four simultaneous conversations but the system is hampered by interference. The new cable will handle 36 calls at a time and, except for rare accidents, will be fully dependable

Use of underwater cables to carry the human voice has been made possible by development of a rugged amplifier called a "repeater" to be placed at 43 mile intervals and built in as part of the cable. The repeater is designed to hold up under pressures of 6,000 pounds per square inch and to last for 20 years or more

After laying the cable to Scotland the ship will return next summer to lay the east-to-west line. The first conversation over the cables is expected to be made late next year.

The system will be linked to the United States through a single cable between Clarenville and Sidney Mines, Nova Scotia, and a radio relay from there to Portland, Maine. The entire network is expected to cost about $4[illegible] million.

WHY DON'T ATHLETES DO BETTER?



by Ernest La France *Condensed from Parade*

Roger Bannister ran the mile in 3 minutes 58 8 seconds to beat John Landy at Vancouver a year ago. He might have run it in 3:50 flat.

Bob Feller has thrown a baseball at a speed of 98.6 miles an hour. He might have thrown it at 100 mph.

Ford Konno of Ohio State University swam 220 meters in 2 minutes 3.9 seconds He might have done it in 2:00.

Sam Snead beat Ben Hogan 70-71 to win the 18-hole playoff of the 1954 Masters Tournament at Augusta, Ga. Both might have beaten the par of 72 by wider margins, scoring perhaps in the mid-60s.

Sound impossible? Not according to a unique study of athletes now being made by a Canadian research organization called Sports College Located in Toronto, Sports College is a nonprofit service founded in 1944 through the YMCA and the Canadian Broadcasting Corp to help raise sport and physical fitness standards. It has spent nine years testing 2,700 athletes of all kinds, analyzing player performances and calculating how they could be improved.

Some of its findings are about to be released to its more than 700,000 members (including American coaches and trainers). Some striking examples:

Practically *all* performances in *all* sports could be improved about 25 percent with better training.

Not a single one of the 2,700 athletes tested topped 65 percent of possible peak performance, as calculated by the testing experts

Only 12 percent of those

Parade (May 15, '55), 405 Lexington Ave , New York 17, N Y

had better than 75 percent of the physical development considered necessary for first-rate competition.

Which is the toughest sport? To find out, Sports College experts first drew up a list of 17 basic attributes—including strength, agility, reaction time, coordination, speed and endurance—that all athletes have to one degree or another. Then, giving gradings of from 1 to 10 for each, they asked coaches and trainers in each sport to rate the degree to which each attribute is needed to play well in that sport as it now is played.

A perfect score would be 170. The average of the experts' opinions came out like this:

Football	135	points
Decathlon	128	"
Basketball	125	"
Hockey	122	"
Tennis	118	"
Pole vault	113	"
Baseball	112	"
Track (sprints)	95	"
Golf	95	"
Swimming (middle distance	94	"
Track (middle distance)	104	"
Track (long distance)	100	"
Swimming (sprints)	100	"
Shot-put	99	"
Swimming (long distance)	90	"
High jump	90	"
Bowling	60-70	"

Sports calling for the most endurance: swimming 440 yards and running an all-out mile.

Job calling for the quickest reflexes: goalie in hockey.

"Baseball," points out Sports College director Lloyd Percival, "is a picnic compared to football in its demands on the player. Except for the pitcher and catcher, everybody gets plenty of rest."

Having found what the sports demanded of players, Sports College set out to measure the players themselves. Choosing 12 of the most important attributes, the experts put successful athletes in each sport through stiff grinds—including obstacle courses, weight-lifting, bar jumps, tumbling, broad jumps, sprints, arm-leg rhythm, etc.—then graded performances from 1 to 10 and totted up the averages.

They discovered that, although an ideal all-around athlete would have a theoretical rating of 120, actual athletes fell far below in the tests. Football players averaged 83; basketball players, 76; hockey players, 72; baseball and tennis players, 71. But pole vaulters topped everyone, with an average rating of 88.

Most of the athletes tested were surpisingly low in strength, considered one of the basic requisities for endurance and good play. Only 1 in 17 could do 25 two-hand push-ups without difficulty. Only 1 in 74 could do a one-arm push-up. Only 1 in 82 could do a one-arm pull-up on a bar.

Speed, another prime requisite of good play, was also conspicuous by its absence. Except for sprinters,

middle-distance runners and basketball players, no athlete rated higher than 6 points out of 10.

After testing individual athletes, Sports College observers set out with stopwatches to clock the speeds needed for throws and runs in actual play. They learned plenty. For example, the average time a baseball player takes to run from first to second base (with a 5-foot lead) is 4 seconds. But the average time for a ball to move from pitcher to catcher and back to second (including the pitcher's wind-up) is only 3.5 seconds. So the average player, trying to steal second, is an almost sure out—unlike the great Ty Cobb, who could run it in 3 seconds flat.

Sports College claims that any baseball player can improve his speed—especially his starting speed—by .3 to .4 seconds if he practices the fundamental mechanics of running known to any track sprinter. In base running this would make a difference of 4 to 12 feet. In the field, it would mean more caught balls: a speed-up of only .1 second over 25 yards would mean an increase of 3 feet in fielding coverage.

Coaches in general scoff, "Why should I train a player to run a mile when I know he'll never have to?" Sports College has some surprises for the coaches. Clocked in actual games (with charts of playing areas marked off into squares), basketball play-

HOW MANY CALORIES DO WE USE PER HOUR?

Brisk Walking (350)

Swimming (1,800-1,900)

Baseball Pitching (400)

All-out Running (3,200)

Dancing the Mambo (350)

Playing Football (1,200)

ers in an average, wide-open game, travel about 3¾ miles, at an average speed of 10½ mph.

Tennis players, in an average five-set match, move about 1¼ miles at an average speed of 12 mph. Football players (backfield) travel about 1½ miles, sometimes close to 15 mph. In a typical National Hockey League game, a hard-working player may travel 3 miles, at 9 mph. (The fastest hockey speed recorded was 26.9 mph.)

Training for greater strength would vastly improve baseball. Tests showed that exercises to develop greater strength in the wrist flexors (front of wrist just below the heel of the hand) increased the throwing speed of 19 players tested by 4.9 mph on throws of 100 feet. One player increased his throw by 9.2 mph by exercising with 5-lb. disks. Swimmers can develop powerful pectoral muscles by lying on their backs, exercising with bar-bells.

Virtually all athletes were found overweight for top efficiency. "Baseball players as a class," says Percival, "eat far too much." They averaged 14 lbs. of excess fat. Other averages: swimmers, 12 lbs.; tennis players, 9 lbs.; football players, 8 lbs. Yet 10 lbs. of excess weight can slow reaction time by at least half a second.

Training for endurance (by building up muscular strength and learning to relax and breathe properly) would improve all performances. It was estimated that the average bas-
ke
he
a

average football player, tested in mid-season, could not run 100 yards without fatigue, with a consequent loss of reaction time, power, agility, mobility and strength. One result: frequent fumbles after long runs.

Sports College evaluations of player possibilities have been uncannily accurate. Director Percival predicted in the Toronto *Star* that Bannister would beat Landy last summer; and stated the whole procedure of the race. He said Bannister had greater strength and will power, though Landy excelled him in tests for flexibility and heart-wind endurance. Percival still claims that Bannister could have run the mile in 3.50 if he had improved his flexibility and thus run more smoothly.

Sports College also predicted that Detroit Red Wings hockey star Gordie Howe would become top scorer in his league. He did. The prediction was based largely on watching him skate circles and figure-8's in both directions. Most hockey players "favor" play either to the right or left. Howe plays both.

Sports College doesn't like to make predictions at random But it has certain convictions. Basketball coaches, it feels, will have an increasingly hard time as their players get taller. Height is an asset up to a point, but usually at the sacrifice of agility and mobility. The court "giraffes" already are showing signs of needing limbering up.

Not all the troubles with athletes are physical. Sports College is still trying to assay the importance of the imponderables — the emotional and

psychological factors. Not until these are fully understood will true super-athletes be possible. But, on what it has learned so far, Sports College thinks it can even do something about that.

• • •

Like any athlete, claims Sport College, *you* can improve in whatever game you play. The secret: systematic training that goes beyond the normal demands of the game. Actual tests with 11 golfers who trained six weeks for greater strength, flexibility and relaxation while playing showed an average improvement of 6.7 strokes per game.

Start by gauging your present physical condition Check your heart rate — an excellent telltale of your ability to stand active sports. Generally speaking, the lower it is, the better your condition

(1) Lie down for 5 minutes, then take your pulse and jot it down. (2) Stand up, take your pulse, jot it down. (3) Subtract 1 from 2. (4) Jog easily in place 1 minute, then note your pulse. (5) Sit 1 minute, note your pulse Now add the figures.

The average normally fit person has a total of about 380, if yours is much above that, you're out of condition After hundreds of tests, Sports College found that the average well-trained athlete has a total of about 360. Roger Bannister's figure: 213.

Middle-distance runners proved to have the best heart efficiency, closely followed by basketball players and swimmers.

Swimming, tennis, golf and bowling are the principal adult participation sports, but the Canadian analysts claim training for strength, flexibility and relaxation applies equally to all sports.

Strength: Not mere muscle size, but the ability to exert power without strain or fatigue was found to be a prime necessity even in "light" sports. In tennis, it means harder, faster serves In golf, it means longer, straighter drives. In swimming, fewer, more-distance-eating strokes In bowling, less error caused by tired hand, arm and shoulder muscles

Sports College recommends general build-up of all your muscles through old-fashioned weight-lifting (even for ping-pong), followed by specialized exercising of the muscles used most. Weight-lifting gives tennis players the powerful abdominal muscles needed, for example, to smash downward at high lobs In addition, players are urged to develop playing muscles by taping books to each side of the racket, or taking a ping-pong paddle in the water and swinging against pressure.

Golfers are urged to build up the muscles that twist the torso to build up power at the club head.

Bowlers are encouraged to handle weights heavier than the ball, and to lift the ball higher than in actual play.

Swimmers build up the vital back muscles that give a "flexible chest" through fast, hard 25-to-50-yard sprints. Once you have the muscles you can go any distance. (Sports College claims fears of getting muscle-bound are baseless) →

ers in an average, wide-open game, travel about 3¾ miles, at an average speed of 10½ mph.

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Training for greater strength would vastly improve baseball. Tests showed that exercises to develop greater strength in the wrist flexors (front of wrist just below the heel of the hand) increased the throwing speed of 19 players tested by 4.9 mph on throws of 100 feet. One player increased his throw by 9.2 mph by exercising with 5-lb. disks. Swimmers can develop powerful pectoral muscles by lying on their backs, exercising with bar-bells.

Virtually all athletes were found overweight for top efficiency. "Baseball players as a class," says Percival, "eat far too much." They averaged 14 lbs of excess fat Other averages: swimmers, 12 lbs ; tennis players, 9 lbs.; football players, 8 lbs. Yet 10 lbs. of excess weight can slow reaction time by at least half a second.

Training for endurance (by building up muscular strength and learning to relax and breathe properly) would improve all performances. It was estimated that the average basketball player loses 4 to 5 inches of height in his jumping ability during a game through muscle fatigue. The average football player, tested in mid-season, could not run 100 yards without fatigue, with a consequent loss of reaction time, power, agility, mobility and strength. One result: frequent fumbles after long runs.

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Middle-distance runners proved to have the best heart efficiency, closely followed by basketball players and swimmers.

Swimming, tennis, golf and bowling are the principal adult participation sports, but the Canadian analysts claim training for strength, flexibility and relaxation applies equally to all sports.

Strength: Not mere muscle size, but the ability to exert power without strain or fatigue was found to be a prime necessity even in "light" sports. In tennis, it means harder, faster serves. In golf, it means longer, straighter drives. In swimming, fewer, more-distance-eating strokes. In bowling, less error caused by tired hand, arm and shoulder muscles.

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Like any athlete, claims Sport College, *you* can improve in whatever game you play. The secret. systematic training that goes beyond the normal demands of the game. Actual tests with 11 golfers who trained six weeks for greater strength, flexibility and relaxation while playing showed an average improvement of 6 7 strokes per game

Start by gauging your present physical condition Check your heart rate — an excellent telltale of your ability to stand active sports. Generally speaking, the lower it is, the better your condition

(1) Lie down for 5 minutes, then take your pulse and jot it down. (2) Stand up, take your pulse, jot it down (3) Subtract 1 from 2. (4) Jog easily in place 1 minute, then note your pulse. (5) Sit 1 minute, note your pulse. Now add the figures.

The average normally fit person has a total of about 380; if yours is much above that, you're out of condition After hundreds of tests, Sports College found that the average well-trained athlete has a total of about 360. Roger Bannister's figure: 213.

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Flexibility: This means the ability to keep your muscles useful throughout the full range of play, and to stretch them when necessary without injury.

To practice: stand with feet wide apart, reach down, grasp ankles, try to touch the floor with the top of your head. Try to do it sitting. Try it standing with feet 4 to 6 inches apart. End by bending knees, placing hands flat on the floor and trying to straighten legs. Not easy—but even the trying helps you.

Relaxation: Sports College claims tension causes most errors (even among professional athletes), much fatigue and many injuries. There are two kinds. One, "affective tension," is the conscious kind you get through anxiety (even fear of going to the dentist tomorrow), fear of losing, "stage fright" or just distraction by some annoyance. (Outside noises, for example, can set up what is called "noise allergy." One out of three golfers tested showed this.) The remedy: think about the game—not about yourself.

Then there is "coordination tension." This involves tightening of the muscles (usually opposing ones) when you get set for a crucial play. Even top athletes who never worry get it unconsciously. Learn to recognize it by deliberately tensing your muscles while not playing; then relax and breathe out. And remember: do your best to carry the habit into your next game.

By regular practice on these three things, Sports College says, anyone can improve in any sport by at least 25 percent. Worth a try, isn't it?

Synthetic Male Sex Hormones

The first direct synthesis of the male sex hormone—testosterone—from simple coal tar products has been accomplished by University of Wisconsin chemists.

The research that led to the synthesis was conducted by Prof. W. S. Johnson and a colleague, Dr. Raphael Pappo, visiting lecturer in chemistry at Wisconsin from the Weizmann Institute, Israel, in cooperation with Dr. Brian Bannister and Dr. E. J. Pike

The only practical method to date for synthesizing testosterone has required a complex natural steroid such as ol be used as a starting-point

Johnson and Pappo synthesized the vital sex hormone from a simple coal-tar product named 1,6-dimethoxynaphthalene, but, they emphasized, the method is not practical in its present form.

Unlike the commercial process, the new method produces both dextro and levo types of testosterone—this means that two different kinds of testosterone molecules are manufactured, each a mirror-image of the other.

The dextro testosterone is the natural hormone manufactured by the male glands. What physiological properties the levo type will have is not yet known.


THE 30,000 WORDS A DAY WE TALK


by Virgil Baker

Department of Speech, University of Arkansas

DO YOU HAVE ANY IDEA how many words you speak in an ordinary, run-of-the-mill day?

Of course the figure varies with different people. Some are naturally "talkers." Others aren't. Then, too, some of us—teachers, salesmen and personnel workers, for instance — talk a lot because our jobs demand it, while those who work mostly alone don't talk nearly as much. But if your temperament, occupation and other obvious factors make you an "average" talker, it isn't unusual for you to speak around 30,000 words a day.

Maybe that seems like a rash estimate, but here's the breakdown on it. Authorities figure that we talk about a third of the time we're awake. That's a third of 16 hours, or about 5½ hours. But let's be conservative and say we spend only 3½ hours a day talking. Not talking a blue streak. Just conversing casually. If we talk at the rate of 150 words a minute, which isn't unusually fast, we're using about 9,000 words an hour, or 31,500 words in a day's stint.

It hasn't been proved that the urge to talk is stronger in women than in men, either. I was pretty well convinced that it is when 30 women had a meeting in my living room while I tried to read a book at the back of the house, but I doubt if the evidence would stand up in statistical circles. Incidentally, my wife assures me that she heard not only what was being said right around her, but got the general drift of all the other conversations going on in the room at the same time! I don't think I could do it, but that's beside the point. Consider, if you're a man, all the small talk and shop talk that goes on at strictly male assemblies, and you'll probably agree that men are about as talkative as women.

What's back of all this verbal bombardment? We feel the urge to talk —but why? Speech specialists have dug into the matter and come up with some reasons that should help us to understand ourselves — an each other—a good deal better. Her is a simplified summary of th findings.

First of all, we talk to give v to our feelings and emotions.

cording to psychologists, this is a perfectly natural and normal thing to do, particularly if the emotions are extremely pleasant or painful. If we bottle up those feelings too tightly—they call it "delaying our emotional responses"—we "blow our tops." Sometimes we give verbal expression to our emotions even when there's nobody else around.

Secondly, we talk to ourselves to find out what we mean. Some people talk to themselves aloud, of course, but usually this kind of talk isn't oral. It goes on silently within our minds. Confused by a fuzzy idea or a memory so vague that it refuses to come to the front, we probe with words to make it come clear. We also toss new ideas about in our minds to discover if the ideas "make sense." We even hold debates with the various facets of our personality, trying to find a satisfactory solution to our problems. And most of us often speak silently to God, receiving in return the inspiration, insights and satisfactions we couldn't get in any other way.

In the third place, we talk because we must break through the barrier of silence to one another. We've been able to work out an elaborate system of thought symbols—a language of words—to help us do this more effectively. A dog can "tell" us it is hungry by the way it looks and whimpers, but it can't tell us so by words. It's only a person can say that he is hungry for ham and eggs.

Every time we say "hello" or "good morning" we feel less alone, for a moment less shut up within ourselves. If we're conscious of this fact, the little inanities with which we greet one another will have more warmth. At the very least, we'll never find them annoying. I remember how, when I was a child, my grandfather's morning greeting irritated me. He'd say "Well, are you up for all day?" I get the same feeling now when someone finds me with my head under the hood of my stalled car and says "Stopped on you, eh?" My impulse is to turn around and say, "Does it look like it's clipping down the road?" But of course I don't say it because I know the stranger means something like this: "Hello, fellow human being. I see you're having car trouble and I want to be friendly and help you."

As for small talk, it is often aimless and rambling, but who cares? In reasonably small doses, it's a pleasant and wholesome way of maintaining contact with those around us.

So much for the basic reasons why we talk: the urge to give vent to our emotions, the desire to clarify our thoughts and establish contact with God by means of inner speech, and the need to break through the silence barrier.

Less fundamental than the three basic reasons why we talk but no less challenging and important are the drives to talk which spring from society. Because we live in a world where inter-action is imperative, we talk to develop inter-action.

No man is an island, it has been said. My life and experience—myself—overlaps your life and experience—yourself. And so we must rea-

son together. We must inter-think. In this kind of talk, the other person gives back to us our own thoughts, plus his Thus, ideas are enlivened and enriched.

Some years ago a friend of mine died. We had gone to college together and had always spoken freely to each other of what was on our minds and in our hearts. After he was gone I felt that a part of me was gone, too. No doubt you have had a similar experience. To practice this sort of inter-thinking—this kind of talk—is to experience friendship at its deepest level.

The "tightened-up" world we live in makes for an intimate and complex society Except in a few highly specialized fields, not many individuals work alone these days. It is truly an age of teamwork. Domestic problems are tackled by committees, clubs, boards, unions, and on the international level by such organizations as the United Nations.

Fewer businesses are owned and operated by one man Many are corporations controlled by managers appointed by stockholders who own the business. Even groups of scientists must team together in long-range programs to explore successfully the immensely complicated facts of nature and to put scientific knowledge into action.

Thus speech—the use of words as tools for inter-thinking—has become a crucial factor in today's world. Personal opinions expressed in thousands of conversations, speeches and discussions, merge into public opinion and laws. The urge to use words as tools for inter-thinking is a creative urge, pushing forward, we believe, toward a better society. A democracy—our democracy—is government through discussion.

Sometimes, we talk not to exchange opinions with others but to press our opinions upon them. This kind of speech is known as persuasion. It, too, came into our Western culture along with the art of discussion The caveman didn't know how to use talk to persuade. He used his muscles, and if they couldn't get the job done he picked up a club. Dictators don't use the art of verbal persuasion, either. They try to control the actions of others by violence and threats.

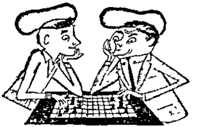
Anytime we use words to "put across a point" we're practicing the art of persuasion. Politicians use it to get votes. Businessmen call it advertising and use it to promote sales.

There are some ethical points involved, of course. Each of us, as a persuader, should be sincere, dependable and honest. If we make promises we should be sure we can keep them. The "smooth talker," the "high-pressure personality" abuses the privileges of a citizen in a democratic society. His ethics are based on the faulty assumption that success depends not on what he is, but the appearance he makes, and the verbal web he can weave.

When the persuasive speech of one man or a few men does violence to the individual or to the group, speech has been used for an unethical purpose. No one has the right to absolute control. A person ha

BRAINWORK ON PEANUTS?

You've probably somewhere read the statement — and likely raised your eyebrows at it—that the human brain uses only two calories of energy an hour in doing such intense work as mental arithmetic. After all, two calories of energy can be supplied by eating between one-half and one-third of a single peanut. Sounds like there's a catch somewhere



Well, there is and it is this: the two calories an hour represent the difference between the energy the brain needs just to keep "idling," like an automobile with its engine going but its wheels not turning, and the energy it needs when it is doing concentrated mental work. Actually the brain, although it is only 1/50th the weight of the human body, uses a fantastic amount of energy; it accounts for about one fourth of the oxygen the body consumes, and has a rich appetite for sugars and fats. This one-fourth amounts to about 25 calories an hour, when both brain and body are idling.

You wouldn't say an automobile cost 15 cents an hour to run because that was the difference between the cost of the gas used idling and touring.

Certainly, thinking takes a lot of energy!—*Fritz Leiber*

BOGUS DREAMS JUST AS REVEALING

Psychoanalytical patients today sometimes claim to have hoaxed their doctor by telling him fictitious dreams. The doctor, not at all put out, explains that bogus dreams are for him as interesting as real ones

What the doctor probably does not know is that this view can be traced back to the 3d century A.D. in China. At that time a famous interpreter of dreams, called Chou Hsuan, was more than once given bogus dreams by people who fondly imagined that they were scoring off him Seeing that the predictions he based on such dreams always came true, a client asked him if it really made any difference whether a dream was real or concocted. "None at all," he answered, "for real dreams and false are both alike products of the soul."

—*Arthur Waley in The Listener (London)*

IDLERS ARE MORE PRONE TO DISEASE

Persons who take life easy are more likely to have heart trouble, diabetes and tooth decay than a hard-working day-laborer, a medical professor said recently, according to the *United Press*.

What's more, physically inactive persons age earlier, die younger and are more prone to backaches, duodenal ulcer, lung cancer, appendicitis, prostatic cancer, psychiatric illness, liver ailments and hemorrhoids.

Doctor Hans Kraus, associate professor of physical medicine and rehabilitation at New York University, made the statements to an American Medical Assn. convention.

He told the doctors they should prescribe physical exercise along with pills to keep their patients healthy. Rest is not necessarily an aid to healing, he said, and may even interfere with it.

Kraus said the physically active person has low weight, blood pressure, pulse rate and tension. He has stronger and more flexible muscles and greater capacity to breathe deeply.

The lazy fellow, on the other hand, is less well equipped to cope with the stress of daily living, he said

Kraus and his associates found that death from coronary heart disease occurred twice as often among the physically inactive

"In diabetics it is well known that steady physical activity greatly reduces insulin requirement," he said.

Exercise, he added, has been found of value in the control of asthma and even in recovery from tuberculosis. Women athletes have much less trouble during pregnancy and labor than girls who have sat on the sidelines, Kraus said

"DRUGGED" ARTISTS PAINT BETTER

How four nationally-known artists reached new heights of creative expression under the influence of a potent drug that produces temporary insanity was disclosed recently to the American Neurological Association, reports Arthur J. Snider in the *Chicago Daily News.*

However, the Cornell University medical team performing the experiment did not recommend it as a means of making better artists or of stepping up esthetic appreciation.

The drug does more harm than good It reduces initiative, disorganizes personality and upsets coordinated movements.

The drug is a white powder known as LSD

It is incredibly powerful. An ounce of it is enough to produce insanity in 30,000 people.

LSD causes the person to have bizarre visual images, fantasies and hallucinations, to see colors that aren't there and hear bells that aren't ringing.

Given to the four artists, who were not named, but described as "nationally-known," the drug caused one to immediately begin painting with "real fervor."

The other three had to be coaxed to paint but when they did, the doctor said, "their greater freedom of expression of form and color resulted in work adjudged by their peers to have heightened esthetic value as compared with those productions rendered before."

The purpose of the experiment was to see what would happen in people who already had a cultivated art sense and visual perception. →

In December 1953, such a case was reported in Indiana—the birth of an infant with two heads, four arms, a single trunk and two legs. What was astonishing was not only the birth itself, but that the baby lived for several months before perishing.

It is generally not difficult to decide whether twins originated from one or two eggs. The two-egg twins, known as fraternal twins, are two independent individuals whose only common endowment is that they developed at the same time in the same womb. They may be of different sexes and may even have different fathers They may show no more similarities than brothers and sisters born at different times. Even their age is not always the same: they may be born several days apart.

The one-egg twins are basically different. They are duplicates of one and the same person. A fertilized egg or a very young embryo splits into two halves, and the halves reconstitute themselves into complete persons. One-egg twins are always the same sex and are usually so much alike that even their friends may sometimes have difficulty in telling them apart.

The author was brought up in a family with identical male twins. The more intellectual of the two graciously took his brother's college examinations. In *Twelfth Night,* Shakespeare presents the twins Olivia and Sebastian, so similar that the girl Olivia can masquerade as her brother. But here Shakespeare identical twins are always of the same sex and fraternal twins are rarely so similiar that they can exchange roles.

According to statistics, in the United States twins are born once in 86 to 88 deliveries. One out of every 44 Americans is a twin. In other countries the proportion is somewhat different. In nothern regions the number of twins is greater—and the farther north, the higher the percentage. Nature seems to safeguard the population of arctic regions, where conditions of survival are less favorable, by seeing to it that more children are produced.

A Frenchman, Hellin, at the end of the last century formulated "Hellin's Law." The ratio of triplets to twins is the same as the ratio of twins to singletons; quadruplets, in turn, occur in the same ration to triplets as triplets to twins, and so on

To understand the origin of triplets, quadruplets, and so on, one basic rule must be borne in mind: an egg will never split into three parts, but only into halves The twins may in turn split, producing quadruplets as a result.

Triplets may originate in any of the following ways:

- Three different eggs may be fertilized in the same month. They can have different fathers and be only half brothers or sisters, even if they are born of the same mother in the same hour. Their sex can be different.
- Two eggs may be fertilized and one of the eggs or embryos may then split in half. These halves result in "identical twins" of startling similar-

ity, while the third is dissimilar and may be of the other sex.

• One fertilized egg may split into twins, one of which in turn splits into halves. All three are "identical," scientifically speaking, and of the same sex. The twins which result from the later splitting will be even more strikingly alike.

Quadruplets are formed either from one egg—with each twin subsequently splitting—or from two, three or four eggs in every imaginable combination. One of the four embryos may perish because it receives too little space or food, and the three survivors are then born as triplets—but actually are the survivors of quadruplets.

> • The human body is the magazine of inventions, the patent office, where are the models from which every hint is taken. All the tools and engines on earth are only extensions of its limbs and senses.
> —Ralph Waldo Emerson

Especially interesting is the case of the famous Dionne quintuplets: all girls, very similar to one another, and having in common some rare characteristics of their toes, eyes and palms. There can be little doubt of their descent from the same single egg cell.

The egg probably split into twins; each twin in turn divided; subsequently one of the quadruplets duplicated once more, and the fifth sister thereby augmented the quadruplets. It is not difficult to group the five sisters, recognize how they are related to each other, and identify the "quint."

It is almost certain that two of them duplicated, and that the mother carried sextuplets in the early stages of her pregnancy. In the third month she lost a "body the size of a duck-egg." This was probably the sixth of the embryos. The occurrence of this abortion doubtless saved the lives of the other five.

The fifth of the babies, presumably the twin of the lost embryo, was extremely weak and weighed only 1 pound, 15 ounces. All five were in a serious condition at birth, and it was miraculous that they survived at all. Without the prenatal death of the sixth, at least one of them would almost certainly have perished.

The survival of quintuplets is a rare event. In the late 1940's quintuplets were born to a wealthy family in Argentina, the Dilligentis. The infants were delivered without the help of a physician and raised without the publicized fame of the Canadian "Quintuplets, Inc." The Argentine father, in understandable fear of publicity, concealed even the fact of their birth for months. These Argentine quintuplets are not one-egg multiplets, since they are of different sexes.

In the future the survival of quintuplets will be more frequent. The general interest, the improvement in communication, prenatal and postnatal care, careful nutrition and medical assistance will combine to safeguard their precarious existence.

According to the statistical chances, quintuplets should be born once in every 54 million pregnancies —about once every year in the worl' Most of them will not be

enough to survive as quintuplets. But there is a chance that in every decade one set will live and offer science the opportunity to study their manifold scientific implications.

The birth of sextuplets has never been authenticated. It should occur once in 4,500 million pregnancies. The survival of sextuplets today seems highly improbable. But in the future, "multiple" pregnancy will be diagnosed long before birth; the rare case will be handled with laboratory care, and the children placed immediately in incubators and fed artificially.

Under such conditions the chance for survival even for sextuplets is not hopeless. But it will be an extremely rare event—so long as science does not interfere with human reproduction as it does today with that of plants and laboratory animals.

Undoubtedly science will discover means of inducing the eggs inside the mother's body to divide once, twice or even thrice through the influence of drugs or radiations. Then, of course, quadruplets or sextuplets could be born at will; but their production is not necessarily a desirable or even a morally justifiable goal.

Test Land, Houses in Wind Tunnel

Wind-tunnel tests are helping farmers defend their land and their homes against wind damage. At a "war college" in Manhattan, Kans., scientists are learning about how much protection different kinds of barriers give. They set up a toy-size farmhouse and tiny trees, fences and fields in the tunnel in various ways, then subject them to wind-machine attacks.

Sawdust snowstorms can be whipped up. Sieved gravel simulates the kind of surface that wind is likely to encounter when it strikes the soil. Wind on the rampage not only carries off top soil, but also robs soil of moisture, piles snow in drifts and works havoc with farmhouse heating.

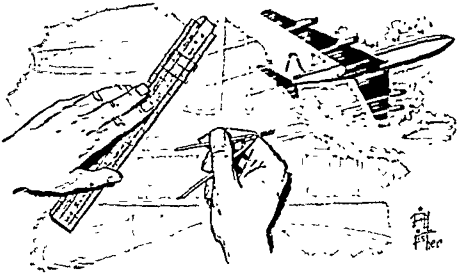
The wind-tunnel data indicate the effects of full-scale barriers under natural conditions if modeling techniques llowed, N. P. Woodruff of the U. S. Department of Agriculture recently reported in *Agricultural Research*.

Primary strategy in placing a barrier is to slow down wind and absorb some of its force, just as mountains, forests and other natural objects do on a grand scale. A man-made barrier affects wind in the same way. It diverts currents of air upward, and causes a drag on the wind at approximately the same height as the barrier.

This lessens the drag on ground surfaces, lowers the prevailing surface wind speed, and creates a pool of relatively calm air.

A single snow fence brakes wind velocity "considerably" to distances of 4 to 10 times the height of the fence.

Four snow fences spaced at distances of 12 times fence height catch about 2½ times as much snow as one fence, and 4 times as much as a solid wall.



DESIGNING TOMORROW'S PLANE

by Henry Dreyfuss

Condensed from a chapter of the book, Designing for People

I PAID my first airplane fare 25 years ago for a flight in a single-engined plane from Chicago to Springfield, Ill. I was the only passenger, and there were no seats. I sat on the mailbags.

My first transcontinental flight was in a Ford three-engined plane with wicker chairs. The trip took three days, and we spent each night in hotels on the ground. By comparison with today's swift, comfortable air travel, that trip seems primitive.

Yet the day is nearing when jet transports will span the Atlantic or America in three hours. It will be a race against the sun, and, allowing for the time change, a person will arrive in Los Angeles the moment he leaves New York.

This new era can be contemplatec only with awe and respect for the engineers who have mastered the science of aerodynamics. But it is wel to remember that whatever the speed, certain fixed economic conditions prevail in commercial aviation To provide regular, reliable servic at rates people can afford, and mak a profit, the airlines must utiliz every ounce of weight, every inch o space.

Fundamentally, the des presented by the airplane turer with the inside of a elastic pickle or cigar. Its

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form, which can vary in size every half inch of the length of the plane, is inexorably set by the laws of aerodynamics. The only thing the designer can squeeze into it is his own imagination.

One of the ironies of making airplane passengers comfortable is that, although the allotted space is inflexible, the airlines demand complete flexibility. Transport planes must be readily adaptable to any type of use. On long trips they carry fewer passengers than normally because they require more fuel. As a result, transoceanic planes usually have greater seat spacing than others. But they must be easily convertible for close seating on shorter, less expensive trips, or be capable of being completely dismantled inside for emergency use by the armed forces or for hauling freight.

Any of these changeovers can be made rapidly because of the tracks installed flush with the floor, the length of the cabin, in most planes. The seats, the bulkheads, even the galley equipment, can be fastened to them so that they are adjustable or removable, should the need arise.

FOR MORE than two decades the name of Henry Dreyfuss has been a synonym [illegible]

ence and the S.S. *Constitution*), look better, work better, and make life easier because of Henry Dreyfuss.

The seat is easily the most important ingredient in the airplane interior. Make a man comfortable, and everything looks rosy to him. He can relax, his food tastes better, the trip seems hours shorter.

We know, too well, that everyone is of slightly different size and proportion, and a seat must accommodate them all. In one case of chair design, we dissented from the advice of doctors that passengers would be less fatigued if harder, spine-supporting seats were used. Psychology is important in flying, and we know that passengers enjoy the luxury and security of sinking into a well-upholstered chair. Today's airplane seat is a compromise.

The airplane seat of tomorrow will be completely adjustable forward, back, up, and down. By the turn of a knob, the passenger will select his choice of several degrees of softness or firmness. The seat will have a retractable leg rest. It will have adjustable "ears," like the old fireside chairs, to provide a headrest and a degree of privacy. The left "ear" will have an individual reading light that will not disturb a neighbor. The right "ear" will have a small, personally controlled amplifier for announcements, radio programs, or recorded music.

Lights, amplifier — in fact, the whole seating unit will be plugged into a handy outlet as a housewife plugs in her electric toaster. There will be space under or next to each seat for baggage stowage. A call bell for the stewardess will be located in the armrest. Most important, the

seat will afford the greatest possible safety in rough air or in an emergency landing

This seems to be asking a great deal of a poor chair, but actually it's not intended to be a simple chair, any more than is a dentist's or a barber's chair. It will be a complicated piece of machinery that affords safety, comfort, convenience, and privacy.

Because it will be self-contained, the seat will be movable, to accommodate heavy or light passenger loads, since it need not be located adjacent to the button and lights now located in the walls of the cabin. The present complication in this shifting is that the chairs will no longer be adjacent to windows

There is a potential solution to this problem Nowadays, a plane's aluminum skin is vital to its strength. Every window or door cut in this stressed skin reduces its strength and necessitates "beefing up" the supporting structure. Some day a transparent metal or a clear plastic with the strength and lightness of titanium may permit a continuous window the length of the fuselage, broken only by rings of framework. Such an arrangement would permit complete freedom in shifting the chairs and provide visibility at any point.

Inherent in this vision is the suggestion that airplane interiors will look different than they do today. We appear to be in a transitional period. Such earth-bound symbols as upholstered seats and carpets and little window curtains have given this pioneer generation of air travelers a security that was needed. Now that they have that security, passengers may anticipate interiors designed along functional lines.

Everything will change except man, the passenger, and with his recently acquired confidence in flight and a maturing psychology, he will be ready to accept an airplane interior that looks and performs like a machine racing through the stratosphere rather than the front parlor it imitates today.

With the jet transport, engineers have made a Flash Gordon dream a reality long before most of us expected it. Industrial designers must now consider new factors and limitations. For example, we have employed every acoustical device to quiet outside engine noises, but supersonic planes will present an eerie silence, and the problem is reversed.

The conversation of 100 passengers in a fuselage could become annoying, requiring the use of sound-absorbing materials. One might well ask, will the quiet of the plane require a general musical background? Or will it demand compartmentation so that those who wish to enjoy that quiet will not be annoyed by passengers who wish recreation?

When we were studying jet transportation for Lockheed, a member of our staff commuted between London and Rome on the British Comets He was impressed with the planes remarkable rate and angle of climb and the relatively low noise level for the power and speed involved. He described this noise as

sound of a rushing wind than the noise of piston-engine aircraft.

Cruising at 39,000 feet gave surprisingly little added sensation of height than normal cruising at 18,000. Passengers, this survey reported, appeared to feel that everything about the flight was normal. This survey will enable us to translate our staff members' findings into the demands of tomorrow.

Not all the problems of passenger flight occur within the cylinder we call the fuselage A major complaint is the length of time required to recover luggage at the point of destination It is annoying to get from New York to Washington in about an hour, then wait 20 minutes for your bag I once kept a little black book for an entire year, jotting down the time of each flight and, alongside, the time it took to get my bags. At the end of the year I mailed the depressing totals to some of my airline friends.

All kinds of mechanical aids have been devised, and ground crews have been intensively trained to speed the handling of luggage, but not too much progress has been made. Lockheed has developed a gondola-type container into which luggage is stored as it is checked at the airline desk. The gondola is wheeled to the plane and fastened to the underside of the ship, where it remains in flight. The process is reversed at the destination.

I carry a bag of my own design, out of which I can live for three days. It fits under my plane seat. Along with my clothes and toilet articles, it contains a supply of large manila envelopes, stamped and addressed, which I use to mail my laundry home each day.

With increased use of synthetic fabrics that can be easily washed and dried and require no ironing, perhaps the ever-increasing flying public will reduce its wardrobe to a minimum and carry correspondingly smaller bags. If small enough, these bags could be carried aboard by passengers and stored either under or adjacent to their seats. Many planes provide for this now.

Nuclear-Powered Seaplane Planned

The Navy has advised Congress it is planning a seaplane with a nuclear power plant, says the *United Press.*

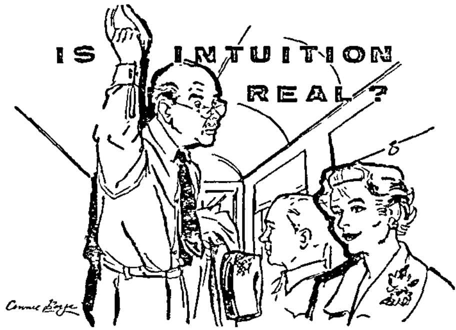
The information was presented to a Senate appropriations subcommittee which is studying the big defense money bill Rear Adm. F. R. Furth, chief of naval research, was the witness.

He said development in aerodynamics and hydromechanics "has demonstrated that it is possible to design and build large seaplanes with speed and ranges not inferior to land-based aircraft."

"Our research has also included design studies of a nuclear-powered seaplane," Furth said.

"Nuclear-powered aircraft offer the obvious advantages of practically unlimited range with very high speed, and a sea-based aircraft offers peculiar advantages for exploring nuclear propulsion in aircraft," the admiral said.

IS INTUITION REAL?



by Eric Berne, M.D.

Condensed from the book, The Mind in Action

JUST as the old family doctor could diagnose typhoid fever "by the smell" because of his vast experience with this disease, so nowadays the observant psychiatrist learns to judge many things about his patients "by intuition." Since he is continually seeing patients and inquiring about their ages, marital status, home life, parents' characters, and so on, it is to be expected that after some years he should acquire the ability to make pretty shrewd guesses on sight.

Such shrewdness is not confined to psychiatrists, nor to the medical profession. Any professional becomes pretty "intuitive" about his own business. Professional age-guessers and weight-guessers at fairs and carnivals make their living through such intuition, which they cultivate by practice and experience. The average person can judge ages and weights fairly accurately, yet perhaps no one could put into words exactly how he makes such judgments. Not even an artist, who is accustomed to copying intuitively the very visual clues from which such information is derived, could explain how he tells the difference between a man of 23 and one of 26. For intuition means that we can know something without knowing how we know it.

Intuition is a fragile and perso
thing, and its study has been e

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discouraged by those who cling strictly to scientific principles and refuse to admit that a faculty exists unless it can be exercised and its effects reproduced at will. Unfortunately, at present, intuition can be exercised only at such times and under such circumstances as the intuiter himself feels are correct. He is either "on the beam" or he isn't.

Here are some examples of intuition from my own experience.

When on night duty in various hospitals, I have been wont to gather social pleasure and bits of knowledge by passing the time with the patients in the wards whenever opportunity offered. One evening I walked into the office of a ward in a large hospital and found one of the patients sitting on the desk Knowing that he should not have been there, he got up to leave, but since I felt that I

other's names. The incident took place in a part of the hospital far from the psychiatric section where I worked during the day, in a ward which was completely strange to me.

Before the man had a chance to say anything, I asked him to be seated again, and inquired:

"Does Philadelphia mean anything to you?"

"Yes," he replied. "I was brought up there."

"Well," I said, "but you left home when you were 15."

"That is correct," he replied, beginning to wonder what was going on.

"If you will permit me to say so," I continued, "I believe your mother disappointed you."

"Oh, no, doctor. I love my mother very much."

"Nevertheless, I think she disappointed you. Where is she now?"

"She's at home. She's not well."

"How long has she been ill?"

"Most of her life. I've been taking care of her since I was a young fellow."

"What's her trouble?"

"She's always been nervous. A semi-invalid."

"Then in that sense she disappointed you, don't you think? She had to take emotional support from you rather than give it to you, from your earliest years."

"Yes, doctor, that's correct, all right."

At this point another man entered the office, and was invited to sit down. He sat on the floor with his back against the wall and said nothing, but he listened with great interest.

"You give me the impression that your father was ineffective from the time you were about nine," I continued with the first man

"He was a drunkard I believe about the time I was nine or ten, he began to drink more heavily."

This conversation took more time than its description does, since it was punctuated by frequent groping silences on my part. The second man now requested that I tell him something about himself.

"Well," I replied, "I think your father was very strict with you. You had to help him on the farm. You

never went fishing or hunting with him. You had to go on your own, with a bunch of rather tough fellows."

"That's right."

"He began to scare you badly when you were about seven."

"Well, my mother died when I was six, if that had anything to do with it."

"Were you pretty close to her?"

"I was."

"So her death left you more or less at the mercy of your tough father?"

"I guess it did."

"You made your wife angry."

"I guess I did. We're divorced."

"She was about 16½ when you married her."

"That's right."

"And you were about 19½ when you married her."

"That's the right answer."

"Is it right within six months?"

He stopped to figure for a moment and then replied:

"They're both right within two months."

There was another long silence, but by this time I could feel the intuitive feeling slipping away, so I said:

"Well, fellows, that's as far as I can go."

"Doctor," said the second man. "Could you guess my age?"

"I don't think I'm in the groove for guessing ages tonight."

"Well, try, Doc!"

"I don't think I'll get this, but I'll try. You were 24 in September."

"I was 30 in October."

These two cases are selected out of quite a large number, mainly because these men later consented to appear at the regular weekly meeting of the staff doctors of the hospital, where they bore witness to the authenticity of the observations.

An admirable opportunity for studying the intuitive process at work was offered in interviewing 25,000 men for the United States Government at the rate of 200 to 500 per day. Under such pressure, the individual "psychiatric examinations" were a matter of seconds rather than of minutes. With such a strict time limit, one's judgments had to be based more on intuition than on examination. In order to study the problem, two stock questions were first devised. An attempt was then made to predict by intuition what each man's answer to these questions would be. The intuitions were recorded, and then the questions were asked In a surprisingly large percentage of cases (over 90 percent), the intuitions were found to be correct. The two questions were "Are you nervous?" and, "Have you ever been to a psychiatrist?"

After confirming these rules in several thousand cases, another study was undertaken. An attempt was made to guess each man's occupation before he spoke, simply by watching him come into the room and sit down. The men were all clothed alike in a maroon bath-robe and cloth slippers. Again it was found that the guesses, or intuitions, were surprisingly accurate. O occasion, the occupations cessive men were gu

by this method, ranging through farmer, bookkeeper, mechanic, professional gambler, salesman, warehouseman, and truck-driver.

Intuitive impressions are not ruled by the laws of chance. It is not a question of being right part of the time through coincidence. When one has "that feeling," one rarely makes a mistake. When one doesn't have the feeling, one's guesses do follow the laws of chance. Guessing the age when 15 men left home and being right in two or three cases would be one thing; guessing different things about 15 men and being right almost 100 percent of the time is another. That is why it is so difficult to study these things properly. They cannot be done by request. The feeling of being "on the beam" comes only at certain times, and then it is gone.

Growth More Rapid During Day Than Night

Growth is more rapid during the day than during the night, Dr. James B. Hamilton of the State University of New York College of Medicine reports

The rate of growth tends to be more alike in brothers and sisters, and particularly in identical twins, than in persons of similar age who are not related.

In mature persons growth declines progressively and materially with age, Dr. Hamilton found.

Instead of using body growth in childhood, he used the growth of nails as an index of growth and replacement of body tissues throughout the lifespan.

He used this index to study growth in 300 male and 298 female Japanese aged 3 to 88 years, including identical twins and members of large families, and 500 male and 250 female white persons aged 5 to 87 years, including identical twins.

Eat for 60 Cents a Day

For about 60 cents a day you can be adequately nourished if you eat the following: a loaf of bread, one-quarter of a pound of butter or margarine, one quart of vitamin D milk and six ounces of orange juice.

This diet was presented by Dr. Rob- [illegible]

popular opinion, experiments cited by Dr. Harris show that a person is hotter, not cooler, on a diet high in sugars and starches. Fats, he said, counteract this.

Doctor Harris does not suggest that anyone try to live on the bread, spread, milk and citrus diet, good as it is.

"For psychological and physiological reasons it is desirable to eat a variety of foods," he said. "I wish only to demonstrate that an excellent inexpensive diet in these United States can be based on bread and spread, milk and citrus. This is the basic diet, from which departures may be made."

After We Land on Mars

by Robert S. Richardson

Condensed from the Saturday Review

MARS is the only planet aside from the earth itself on which we have been able to detect evidence of life. There may be myriads of other stars besides our sun with planets revolving around them on which life has developed. We do not know. At present it seems unlikely that we will ever know. So far as life in the universe is concerned we are alone with Mars.

Until very recently the idea of travel beyond the earth has hardly been more than a vague dream Now suddenly the spectacular advances in rocketry and electronics have made space travel a possibility within our lifetime—within the next ten years, according to some.

The prospect that unfolds before us is dazzling. The opportunities for discovery seem unlimited. And our enthusiasm for exploration in space is unbounded.

In the excitement of the hunt we have paid little attention to ject of the chase. We have ered to question if the

The Saturday Review (May 28, '55), 25 W. 45th St., New York 36, N. Y. Copyright 1955 by Sloan Wilson

the candle. Or if colonization of another world might lead to repercussions of a highly disturbing character. If we succeed in reaching Mars the total cost will run into the billions. It will be the biggest real-estate deal in history. What can we expect for our money? What kind of a world is Mars?

In appearance, at least, Mars is not so different from the earth. Many regions of the earth must resemble Mars so closely that you could not tell which was which from a photograph. An artist friend of mine who has made a name for himself depicting planetary scenes tells me that Mars is his hardest subject. Editors balk at paying for a picture supposedly representing Mars when their readers are likely to mistake it for the country around Reno or Las Vegas. For Mars is practically all dry land and most of that land is desert.

Mars is often referred to as a small planet, and it is true that its diameter is only about half that of the earth's. But we must remember that three-quarters of the earth is covered by water and uninhabitable. When we compare the two globes on a dry-land basis Mars is found to be almost exactly the same size as the earth.

On the earth we immediately associate the word "desert" with "heat." On Mars, however, the situation is reversed. Over most of the planet the climate is similar to that of a cold high-altitude desert, such as the plateau of Tibet. Since Mars on the average is 50 million miles farther from the sun than the earth is we would naturally expect it to be considerably colder there, and actual measurements with sensitive heat-detecting instruments confirm this conjecture.

At noon in the tropics of Mars the average temperature is about 40 degrees Fahrenheit. The atmosphere is so thin and dry that it has very little blanketing effect. Thus, the highest temperature comes near noon instead of about three o'clock in the afternoon as on the earth. The temperature falls rapidly until at sunset it is 10° F.

Since the unilluminated side of Mars is never turned directly toward the earth we cannot measure the temperature at midnight, but it must be very low, say —20° F. A temperature of —90° F. has been measured at the Martian poles, and during the long polar night it may drop to —150° F. On the other hand, a temperature as high as 85° F. was once recorded at a dark spot near the equator when Mars was close to the sun. For comparison, the highest and lowest temperatures ever recorded on earth are 136° F. in Tripoli and —90° F. in Siberia.

Mars undoubtedly has a thin atmosphere of some kind, as the familiar markings on the disc are often obscured by haze and clouds.

Unfortunately, our knowledge of the constitution of the Martian atmosphere is mostly negative in character. For example, we know that it does not contain any oxygen, or at most, less than 1 percent of the amount in our atmosphere. Since oxygen is essential to all but the lowest forms of life it seems improbable that we will ever be destroyed by invaders from Mars.

At present our best guess is that the atmosphere of Mars is made up of inert gases like those in our own atmosphere, with the oxygen left out.

Water also is an exceedingly scarce article on Mars. Among the easiest markings to discern are the white caps at the poles, which expand in winter and shrink with the approach of spring The most natural explanation is that they consist of a thin deposit of frost and snow. For a while it was thought they might be frozen carbon dioxide, or dry ice, but this idea has been abandoned. (The polar caps are too warm!)

• *Those who refuse to go beyond fact rarely get as far as fact* —T H Huxley

This deposit of snow at the poles appears to be the only source of water on the entire planet. To us it would seem pitifully inadequate. Long ago, Prof H. N. Russell of Princeton strikingly illustrated the perpetual drought that prevails on Mars when he remarked that all the water on the planet would hardly fill Lake Huron.

Although it is hard to make out a case for animal life on Mars, the evidence for plant life is good. There are still a few dissenters, but I believe that most astronomers today are willing to admit the existence of Martian plant life.

The distinctive red color of Mars comes from the barren deserts in the northern hemisphere. But the southern hemisphere up to about latitude 40° is girdled by dark green areas called *maria*. As the name indicates, these areas were once thought to be actual seas.

It seems incredible today that our grandfathers could have been so wrong The maria show seasonal changes which suggest the growth and decay of vegetation. In winter they are dim and gray or brownish in tint. But as spring comes on and the polar cap begins to melt, a "wave of quickening" proceeds toward the equator and the maria grow darker and turn to green It seems almost certain that the maria must undergo regeneration each year, as otherwise they would have been obliterated by the desert dust.

The chief objection to the vegetation hypothesis is the absence of oxygen and the limited supply of water Also, the sub-zero cold would rule out most types of plants It is possible, however, that such extremely hardy plants as the lichens might be able to survive, as their adaptability to adverse conditions seems virtually unlimited This does not mean of course that there are lichens growing on Mars. If the gre maria consist of vegetation it is p ably of a different type from

Let us look ahead to a time

space travel has become a reality. The journey to Mars is still hazardous and beset with difficulties, but it is no longer a major problem. However, the length of the trip is hard to specify at present; there are many uncertainties involved. One plan which has been worked out in detail puts the round trip at nearly three years. This includes a stay on Mars of 449 days. Even making liberal allowances for technical advances it appears that the time spent on the road will always be considerable. (Unless, of course, atomic fuel becomes available.)

By a stupendous effort a station of several hundred young unmarried men has finally been established on Mars. Needless to say, the personnel was selected with the utmost care to eliminate those with physical defects and undesirable personality traits. Transporting men from the earth to Mars and back is an exceedingly expensive and difficult proposition. For this reason the men cannot be rotated as rapidly as is desirable. A man who volunteers for Mars must do so with the expectation of remaining a minimum of, say, five years on the planet.

To insure a permanent supply of water the station should be located at one of the poles. We will put it at the north pole since this one has never been observed to disappear completely in summer. A steady water supply would also solve the oxygen problem, since oxygen could probably be obtained most easily on Mars by decomposing water into hydrogen and oxygen.

Locating the station at the pole has the disadvantage of a long night with its frightfully low temperature. But it is going to be cold wherever you build on Mars. And it is doubtful if the men would be much less miserable at the equator.

If we are able to get to Mars in the first place we should be able to build dwellings where the men can live in reasonable comfort so far as their bodily needs are concerned. But it would be an unnatural existence, as restricted as taking up residence in a submarine.

One could never step outdoors without suitable oxygen equipment. Since the atmospheric pressure is probably from 10 to 20 percent of that at the surface of the earth an airtight spacesuit would not be necessary. But even short trips would be dangerous owing to accidents to the oxygen equipment, and the chance of being caught outdoors at night without ample protection against the cold.

Exploring parties could probably make field trips by airplane despite the low density of the air, since gravity is only 37 percent of that on the earth.

Only a few of the men would work outdoors. Most of the men's time would be spent inside the walls of the station. The work would be of a monotonous character—analyzing and classifying data secured on field trips, writing up reports, and transmitting the results to earth.

A man would never be alone. Every hour would be closely restricted and regulated. The discipline

could never be relaxed; the least slip might result in disaster. A man would lead a precarious life, but it would lack the stimulation that comes from exposure to imminent danger. It would be an endless war without a truce or a victory.

Why should we risk lives and spend billions of dollars to reach such a desolate world when there are vast regions so much closer home that are still blank spots on the map? Because we will find new elements or precious mineral deposits? Impossible Because occupation of the planets will be useful for military purposes? Nonsense Because we will find a type of intelligence far greater than our own? The odds are overwhelmingly against it.

Yet I feel confident in my own mind that if we attain the technical ability to travel to the planets we will do it. Furthermore, we will do it knowing perfectly well what to expect in advance.

Why?

Well . . . for no better reason than man's insatiable and restless curiosity to see what lies beyond his horizon Because there will never be any peace for us until that challenging gap between the earth and Mars is bridged We should quit trying to think up logical, sensible reasons for space travel There are no such reasons. If we ever reach Mars it will be because we were lured there by that same vague but irresistible urge that led men to make one assault after another on Mt. Everest: "Because it's there."

In my opinion, the only valid reason for journeying to Mars is pure scientific investigation. There is no question that a station on Mars would add to our store of basic scientific knowledge.

For instance, we would like very much to know about magnetic conditions on Mars, or any planet for that matter. What is the strength of the magnetic field? How does it vary?

The biologist would seem to have the biggest stake in such a trip. If the maria consist of vegetation he would be in much the same situation as Galileo with his first telescope—wherever he looked he would be sure to make an important discovery.

Imagine the delight of a biologist able to study plant life that had originated under extraterrestrial conditions. Biologists like to think of plant succession, photosynthesis, and natural selection as fundamental principles of life. But the fact remains that they have been studied only under the conditions that prevail on the earth, and their universal nature can only be inferred.

There are many other problems that would be crying for study. The difficulty would be in trying to decide which ones to do first. Whether the taxpayers would be willing to foot a bill of $10 billion to learn that the magnetic axis of Mars is inclined seven degrees to its axis of rotation is a question My hunch is they would not care particularly. Going to Mars would be a lot of fun and excitement, a trip in which we coul vicariously participate. Go and spend the money!

Rebuilt Teeth and Bones?

In the near future missing teeth and bone structure may be rebuilt or replaced with real bone as the result of a far-reaching discovery by which artificially softened bones can be rehardened.

A team of scientists have taken the minerals out of animal bones making them soft and sponge-like Then they have succeeded in re-hardening or "recalcifying" them by treating them with certain chemicals and placing them in a solution similar to the body fluids.

This finding presents the possibility that dentists may be able to take this soft "demineralized" bone, treat it chemically, and then insert it as a "natural filling" into a drilled tooth cavity, where it would harden and become part of the tooth. In addition, teeth may be prevented from falling out by building up the bone around them.

Orthopedic surgeons, too, may be able to use this process to speed the healing of fractures or to replace bones lost or removed by accident or disease

The doors opened for these revolutionary advances in dentistry and surgery are described in a paper submitted to the Federation of American Societies for Experimental Biology by Dr. Albert E. Sobel, chief of the biochemistry department of the Jewish Hospital of Brooklyn, N. Y.

Drug for Juvenile Delinquents?

A drug may prove to be the solution to the much-discussed problem of juvenile delinquency.

The drug is chlorpromazine. It has already won praise for its ability to quiet greatly disturbed mental patients so that they can be given helpful psychiatric treatment

Its promise of helping solve the juvenile delinquency problem comes from that same quieting or tranquilizing action. When given to destructive, incorrigible children who seemed well on the way to becoming delinquents, the drug within one week transformed the youngsters into calm, cooperative, better-behaved children who no longer resisted psychiatric efforts to help them.

These good results in 39 of 45 children were shown in an exhibit for the American Medical Association. The children were treated by Drs. James A. Flaherty and Robert L. Gatski at the Governor Bacon Health Center, Delaware City, Del

The children had previously resisted all attempts to help them through psychiatric treatment, change in home environment and child guidance. Even when given barbiturate sleeping medicine they still kept their disturbed feelings and confused ideas hidden from the doctors When given the new drug they calmed down enough to tell their troubles and get help in facing and overcoming them.

by Roy L. Abbott
Professor of Biology, Iowa State Teachers College

I HAVE ALWAYS THOUGHT of birds as being more or less set in their ways of doing things, and as the result of watching and studying them for many years I believe I am not far wrong in that thought. But now and then one of them greatly surprises me by its behavior, as for example, on two occasions during the past summer.

Do our common summer residents ever use the same nest twice? I've long had a curiosity to see definite proof of a "yes" to that query, and when a pair of robins had brought their brood to flight-maturity by mid-May in a nearby Douglas fir, I fairly haunted that vicinity for two weeks, keeping careful check upon the abandoned but still serviceable nest.

Did they go back to it? No, but a mourning dove did. There she was, one morning, with one egg already laid. Two more came a few days later and she brought the three to dovehood in that robin's nest just as if she owned it. Surprise No. 1!

SURPRISE NUMBER TWO came a few weeks later when, on a field-trip with a nature-study class, we saw a rather astonishing sight. A mourning dove had her nest in a red cedar perhaps six feet from the ground. That was not uncommon, but her surroundings were. For, almost touching her nest, was a dead, bronzed grackle hanging by its feet from some twine in which it had be-

dove was sitting, for her young had just hatched. Yet she was seemingly not in the least bothered by the corpse at her door.

But through the years I have had other bird-surprises. For examp' I had never supposed that would actually strike a ' in defense of their nest,

years ago, both the male and female owners of a nest drubbed me soundly while I stood on a stepladder lifting their young from the nest.

Each bird came at me like a miniature dive-bomber, and each knocked blood from the back of my hand.

HERE IS yet a stranger antic performed by a robin. In this case a cowbird had invaded a chipping sparrow's nest in one of my small blue spruces. One evening, the foolish chippy was busily feeding the rascally young cowbird which had come from this invasion, and which by this time was so large its bulky body was spreading out over the nest's edge like bread in a pan.

Presently, I heard the plaintive cry a robin makes when she has lost her young. Almost instantly this particular robin appeared and began running over my lawn gathering earthworms Then what? Well, she flew straight to that blue spruce and stuffed her catch into the wide mouth of the young cowbird.

She repeated the performance several times. I could scarcely believe what I was seeing. Two foster parents for one miserable parasite! I was so exasperated I was tempted to finish the cowbird then and there, but a heavy wind and rainstorm that night saved me the trouble, by upsetting the nest and drowning him.

I HAVE SEEN bald eagles robbing hawks of their catch, but until recently I didn't know that such "hijacking" occurred among our smaller birds. Last summer I found out.

In this instance, a male robin was busily searching for earthworms on the campus at the Iowa State Teachers College. I noticed a house sparrow following close behind and watching him intently. Presently the robin pulled out an earthworm, but seemingly, before he knew what was happening, the sparrow flashed in, grabbed the worm and was off to its nest in an eve trough.

I watched the sparrow closely and in half a minute he was back camping on the robin's trail. What's more he performed this worm-snatching act three times in perhaps the five minutes that I watched this rather unusual behavior. So far as I could see, the robin made no attempt to fight the sparrow and paid no attention to its presence.

I DIDN'T SIT in on the following bit of bird behavior; I had it from my brother who lives in a brick house in Muscatine, Iowa

"I heard a noise behind the fireplace shield there," said my brother, pointing to the big metal screen, "and when I lifted it aside what do you suppose I found? Well it was a drake, blue-winged teal, and as sound as a dollar except he was pretty much smudged with soot. I carried him to the front porch and he took off in high gear for the river. How do you suppose he got in there?"

I don't know the answer to that one nor to many of the strange antics which I've seen birds perform. But I'm now sure that they are not quite so set in their ways of doing things as I had once supposed.

200-MILE TV TRANSMISSION

Direct television and multi-channel telephone transmission through space for as much as 200 miles—without relay stations and at ultra-high frequencies—has been accomplished, Bell Telephone Laboratories and Massachusetts Institute of Technology report.

Television pictures, as well as radio and telephone conversations can be sent over the horizon on ultra-high frequencies, in an extension of a transmission technique recently applied to the continental defense system

Principal virtue of over-the-horizon transmission is that longer communications bridges are possible over water and rugged terrain In the present microwave radio-relay network across the United States, relay stations are 30 miles apart.

Standard AM radio broadcasting employs waves that follow the earth's curvature But waves used in television and telephone relays were presumed to travel in a straight line. For many years, "line-of-sight" transmission between antennas placed on towers on the horizon (about 30 miles apart) was thought to be the only practical means of transmitting by radio the wide bands needed for television and multi-channel telephone service

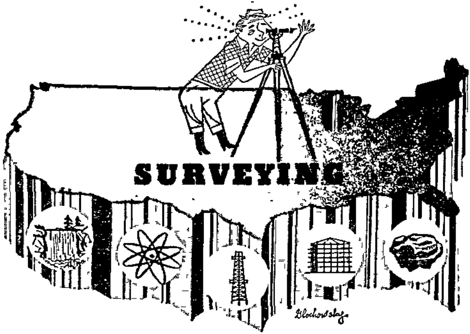
This was disproved after years of research at M I T. and the Bell Telephone Laboratories The Bell Laboratories' research stemmed from Bell's success with transcontinental microwave systems for carrying telephone conversations, radio and television programs from coast to coast and their continued interest in radio propagation. The M.I.T. interest was stimulated by work for the government in radar and overseas broadcasting.

Scientists knew that ultra-high frequencies traveled over the horizon under certain conditions but believed them to be too weak and undependable for practical use.

In the course of investigating occasional interference attributed to these waves, however, the scientists discovered that many actually overshot the relay towers they were aimed at and arrived at farther points with remarkable consistency.

The next step was to provide reliable long-distance transmission over-the-horizon. M I T. and Bell Laboratories engineers did this by erecting larger antennas and using higher power than is employed in the conventional microwave system Thus, they put to use the weaker signals that drop off a straight radio beam beyond the horizon and are reflected or scattered to distant points by the atmosphere.

The effect of the new system is very much like that of a powerful searchlight, which casts a beam in a straight line. A searchlight aimed at the sky can be seen from the ground miles away, even when the searchlight is behind a hill. This is possible because some of the light is reflected to the the atmosphere.



SURVEYING OUR UNDERGROUND RICHES

by Robert Froman

Condensed from Coronet

ONE of Washington's least-known federal agencies recently received a letter from a Denver man.

"I retired not long ago," he stated, "and have been looking for something to keep up my interest. I think maybe prospecting will do. Please send me a map of all the undiscovered gold mines located in Colorado."

Government agencies receive many such weird requests. But the agency to which this one was directed—the U. S. Geological Survey—could very nearly have fulfilled the request if it had the time, money and inclination. For the Survey, as staff members call it, has been studying the country from the ground down for 76 years, and its files are a vast catalog of what lies beneath our good earth, as well as its surface waters, its streams and lakes.

"You might say," notes Dr. William E. Wrather, director of the Survey, "that we're the certified accountants of the nation's natural resources."

In the process of keeping their natural resources accounts, Dr. Wrather and his associates have developed some remarkable techniques as well as helped to pioneer whole new scientific applications, such as geochemical prospecting.

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An offspring of a union of geology and chemistry, "geochemistry" is, in one of its main applications, the science of detecting underground mineral deposits by analyzing the waters of rivers and creeks which pass near the deposits so carefully as to detect the presence of minute traces of the minerals sought. Once on the trail of a mineral, the geochemists can track it upstream to its source, and they sometimes achieve fantastic results.

A few years ago one team of experts detected a trace of zinc in a backwoods creek in North Carolina. For several days they tracked it upstream, losing the scent occasionally, then finding it again. When they reached a point above which no further trace could be found, they fanned out through the woods When they reassembled later, one of them wore a broad grin.

"I found it," he announced.

"What do you mean 'it'?" he was asked.

"There's a farm up the hill here," he explained. "The farmer bought himself a new porcelain bathtub and threw out the old galvanized iron one. It landed in a spring in the pasture. That's our zinc deposit."

Such disappointments are rare, however. More typical is the actual zinc discovery recently made in eastern Tennessee.

The Jefferson City-Mascot area northeast of Knoxville has long been an important source of zinc, and a couple of years ago known reserves were beginning to run low. The Survey's experts tackled the problem not as prospectors but as theoreticians.

From charts, aerial photographs and the plans of the mines in operation, they soon found that all the known deposits lay along a horizontal geological fault, a sort of crinkle in the subterranean rock bed where one stratum of rocks had pushed another out of line. In the same area they found another fault which was different only in that it descended vertically into the earth instead of paralleling the surface.

"Try digging there," they suggested to the miners.

The result was the discovery of new reserves estimated to amount to at least a million tons of zinc concentrates. With reserves of many of our basic raw materials dwindling year by year, such discoveries are of incalculable importance.

"You see," Dr. Wrather explains, "nearly every square foot of the surface of this country has been prospected. Now we must probe beneath the surface. That's where the science of geology in general, and our agency in particular, come in."

Congress established the U. S. Geological Survey in 1879 to explore and evaluate the extent of our natural resources In later years Congress gave the Survey the additional tasks of making topographic maps, studying water resources and supervising mines on the public domain. Today the Survey's staff numbers more than

sciences.

Currently, its four divisions are

Conservation, Water Resources, Topography and Geology. The Conservation Division supervises operations on 97,000 oil, gas and mining leases on federal and Indian lands and accounts for mineral production valued at half a billion dollars. About $34 million is collected in royalties, leases and other payments on the mineral production of these public lands. The Conservation Division is unique among government bureaus because it turns over to the Treasury about 2½ times as much money as it uses from funds supplied by the Bureau.

The Water Resources Division keeps tabs on the flow of surface water and locates and describes underground water to determine its quantity, chemical quality and usability. The division's chief, Carl G. Paulsen, takes a dim view of the concern of many scientists over water shortages, explaining:

"Our country has been blessed with water. With oceans to the east and west and the Gulf of Mexico to the south, we are surrounded by giant tea-kettles which generate our continental moisture. No long-term trend toward a decline in our overall surface water and ground water resources has been observed within the past few decades of study."

It is true, he admits, that some important areas and industrial centers like the New York-New Jersey and Los Angeles metropolitan sections, have lowered their ground-water tables by heavy pumping. In some cases, such as Arizona, the economy of a whole state is in the balance as a result of depletion of water supplies.

But these are generally problems of distribution, not of supply.

Water aplenty for New York, for instance, soon will be made available by tapping the Delaware River; and when the pumping can be slowed, the ground-water tables will rise again

• He who knows the most, he who knows what sweets and virtues are in the ground, the waters, the planets, the heavens, and how to come at these enchantments, is the rich and royal man.
—Ralph Waldo Emerson

With bad news about other natural resources cropping up so frequently, this is remarkably heartening news

Among the chief purposes of the Survey's remaining two divisions, Geology and Topography, is the turning of much of this other bad news into good. The topographers and geologists work in close cooperation. The maps produced by the former are portraits of the surface of the earth, and when the geological details have been superimposed on them, they provide clues to much that lies beneath the surface.

Both divisions trace their origins far back into the nation's history. In fact, even before the states were firmly united, the Continental Congress appointed a geographer "to take sketches of the country and seat of war." And beginning with the famed Lewis and Clark Expedition to the Pacific Northwest in 1803-6, the federal government kept a long series of geographers busy exploring the West.

Today, not much more than a fourth of the country has as yet been adequately mapped.

This unbelievable state of affairs is explained in large part by its very unbelievability. Everyone knows that any service station will provide fine highway maps of its own and surrounding states, and that there are numerous atlases full of maps of individual towns and counties. ,

But World War II quickly demonstrated the limitations of these ordinary "flat" maps. For you cannot build a bridge or an airfield, or find a good location for a munitions plant, on the basis of the information provided by them. Lacking supremely accurate, large-scale maps showing the contours of the land, it often took weeks of precious time and large sums of money for surveys even to lay out a plan for a training camp.

The Survey's Geology Division has developed ingenious techniques for making over-all studies of huge areas. One of these is known to staff members as "giving America the bird."

The bird in this case is a refinement of the aerial magnetometer, a device developed during World War II for the detection of enemy submarines Trailed from a plane, it now detects variations in the magnetic properties of subterranean rocks. Such variations provide clues to subsurface geology and have occasionally led to the discovery of great new reserves of raw materials.

In northern Minnesota, the bird has hinted at what may prove to be a vast extension of the great Mesabi iron ore deposits and of sizeable new

nickel reserves. Indications of other iron ore have turned up in northern New Jersey and in New York's Adirondack Mountains.

The new technologies of electronics, rockets and atomic energy demand raw materials whose names, a decade ago, were known outside university tories. Niobium, germaniu

lanthanium, zirconium — these and many other comparatively rare elements have graduated from curiosities to necessities.

Survey researchers have turned up new sources of niobium (also called columbium), an essential alloying element for rocket engines, in the waste products of aluminum plants using Arkansas bauxite. They have found a potential source of germanium, used in electronic transistors, in the ashes of certain Ohio coals. And they are hot on the trails of at least 15 other rare elements.

Most important of all, of course, is uranium, and the Survey's experts work with the Atomic Energy Commission in developing uranium prospecting techniques. One of the most remarkable of these is geobotany.

In the arid Southwest where much of the uranium search is concentrated, tough little junipers and piñons send roots deep into the earth in search of moisture. If the soil also happens to contain uranium, these roots pick up and transmit to the surface a few radioactive particles. The Survey has worked out a method for testing the needles of these trees to determine whether their roots may penetrate deposits of uranium.

When the cold war reached subzero depths, Russia abruptly cut down its exports of manganese, a vital ingredient of many steel alloys. Most of our supplies of manganese we must import.

One other big source was India. But with her newly won independence, India was planning a great industrialization drive and was considering embargoing exports of manganese in order to preserve supplies for her own eventual use.

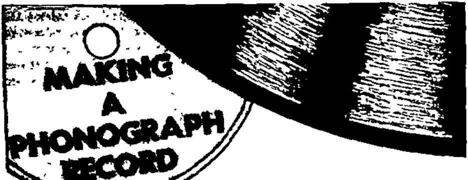
Two Survey geologists spent a few months studying India's manganese workings and prospecting neighboring areas. They were able to prove vast new manganese reserves sufficient to last for generations, and the Indian government gave up its plan to stop exports. The Survey's foreign geology branch, headed by W. D. Johnston, Jr., ranges over most of the world, helping friendly nations gain new understanding of their own resources.

Even in its domestic dealings, the Survey frequently has need of diplomacy. When someone wants a topographic map of an area which has not been mapped yet, a lot of explaining is necessary. The explanations are not always successful

An Iowa City man once asked for such a map of Mendocino County, Calif. On receipt of the Survey's explanation that it had not yet been able to do that job, he was indignant.

"I know why you haven't mapped it," he wrote. "It's inhabited underground by Deros, a form of humans, that steal or kidnap people and torture them. All government vehicles that go into the county disappear without a trace."

The Survey doesn't think this is an accurate description and will someday publish a map of the county, made by staff members who bear no scars of torture.



MAKING A PHONOGRAPH RECORD

by *Elliott H. Kone*

Condensed from The Yale Scientific Magazine

AT THE TURN of the century the American public found occasional noises an exciting thing. The unusual event of a fire and the horse-drawn engines, the loud railway locomotives, a parade, fireworks displays, carnivals and even the sound of whistles; anything slightly noisy would be cause for a thrilling tremor and slight pulse-increase in most people. This was because the average community was relatively quiet. Automobiles, airplanes and radio had not yet raised their clamor to our Babel; inhabitants of the city or country were still able to be stirred by a public orator or a community band concert.

Within a short time the airways were filled with sound, the automobile and other mechanical transportation had added their levels of noise, the motion pictures soon poured out with soft phrases or sharp gunshots and phonograph records had been made by stars of opera and the orchestras of jazz and blues.

The living-room had replaced the outdoors for selective sound and people were content to hear their favorites, as long as they were distinguishable and identifiable. To them, adequacy of tone was sufficient . . . one's imagination usually took over when something was lacking in quality.

As our tempo increased and with it the noise level of everyday living, admirers of classical music began to retire more frequently to the concert hall or else grew more discriminating in their selection of phonograph records and equipment. The entire field has traveled a long distance since Edison etched a rotating wax cylinder beneath a small steel needle

At the end of World War II Columbia Records introduced the LP, or 33⅓-rpm microgroove phonograph record, which transformed the phonograph industry. For the first time, imprisoned sound could be reproduced with an amazing faithfulness of tone, at a reasonable cost
a far greater ease of

The Yale Scientific Magazine (Apr. '55), 244-A Yale Station, New Haven, Conn. Copyright 1955

the recordings would play from 40 to 60 minutes each. This was made possible in part by the advent of tape recording which could capture the performance sounds with great fidelity and also be edited easily to fit recording specifications. RCA followed soon after with its 45-rpm disks and have recently introduced their new "extended play" records.

Except for the changes in speed and the method of making the original recordings, however, the process of producing phonograph records has remained almost unchanged.

• • •

The making of a disk usually begins in a studio, where engineers record the sound on magnetized tape. Production men leave the session with several reels of tape which

est bits of the studio performance; and cutting away the tune-ups, studio noises, special cues and also inferior passages which were repeated.

John Molleson describes that cutting the master begins with a perfectly clear disk, smooth as a mirror and just as shiny. A sapphire cutting-stylus, heated by a glowing hot wire, receives the amplified sound patterns from the tape and etches them in a spiral track on the thin lacquer surface of the disk. On one side of an average LP, the track is a half-mile long. The cutter is a complex, precision-made machine which is housed in a dust-free, air-conditioned room. The operator usually precedes a cutting with a test to see —through a microscope—if the LP cut is of the right depth (about .003 of an inch) and the grooves are evenly spaced (about 300 to an inch).

The space, or "land," between grooves may be widened in loud sections, narrowed in soft passages, to improve quality and save playing time on a disk. This is done automatically by a pilot player which "hears" the tape in advance of the stylus and adjusts the spacing mechanism to coincide with the fluctuations in volume. During the cutting, a small nozzle immediately above the stylus sucks up the highly inflammable "chip," or residue lacquer, which is carried off by a vacuum and dumped in a water-filled jar. The completed disk is then wrapped, sealed and sent to the processing plant.

At the plant the disk is dunked in a bath of stannous chloride, showered with water from a hose, then sprayed with a coating of silver nitrate which gives it a gleaming surface. After the silvering the disk is placed in a plating solution, where a rigid copper backing is built up on the thin film of silver molecules.

When the copper layer is sufficiently thick the disk is removed from the tank and the lacquer master is pried away with an inserting tool. Usually this destroys the fragile lacquer, but the metal mold carries a perfect mirror impression of the grooves.

This metal matrix is a negative and could normally be used to stamp out positive records. One stamper, however, would not be enough for the mass production of records. Once

worn out, it could not be replaced. So the plating process is repeated on the matrix—this time to make what is called a "mother," a duplicate in metal of the master.

Repeated plating of the mother results in a multitude of stampers, the third-generation offspring of the original lacquer — master to matrix to mother to stampers. These stampers are the work horses of the industry, the moulds of the vinylite disks.

Pressing a record is something like making a waffle. The heated gobs of softened vinylite await the operator on his right On his left are the record labels, in two stacks several inches high Before him is the press, with steam-heated jaws capable of tremendous pressure, each snugly fitted with its stamper.

The operator builds a sandwich in the open press. First the lower label, then the vinylite, next the upper label. Down come the jaws, and in a hiss of steam the record is made. Automatically-timed gadgets replace the steam with water in the press, cooling the disk from 300 degrees to something like a normal temperature. The jaws open in less than a minute, the operator takes out the finished record, sets it on a stack and repeats the process.

One out of approximately every 60 records is played in the factory, and then not for enjoyment. A row of soundproof booths house some patient women whose working hours are filled with music—bop, Beethoven or Palestrina. Their ears are attuned to possible flaws on the disk surfaces.

Sometimes a hair on the stamper, or a bit of dust, will have caused the blotch. These can be removed and the run can continue. Occasionally a more serious defect has ruined the stamper, and production from that press will be halted until the stamper is replaced. This aural check is supplemented by a visual inspection of every record by another group of girls, who wear white gloves and give each disk a close look and a quick polish before inserting it in its envelope.

Columbia and RCA Victor have followed the technical advances of the plastic industry and have found that a special "injection" system has allowed moulds to last several times longer than they did in the old stamping method.

But LP's still do not constitute the bulk of the industry, either in total sales or in the money brought in Those turning at the old speed of 78 rpm have been losing ground year by year, but they still account for the greatest sales. In 1953 the 122,177,106 old-speed records sold realized $89,726,604, which was more than the totals brought in by either 45's or LP's.

It might surprise some—especially those who confine themselves to collecting classical music — that the business in 45's is considerably larger than in 33⅓. In 1953 the latter netted $32,814,728, whereas the 45's — and this includes extended-play records as well as the small disks— netted $49,265,345.

Of these sales, 95 percent made by eight record

Victor, Columbia, Capitol, Decca, M-G-M, Mercury, Golden and King (the last two also make children's records).

Recently, records have been issued by Columbia and also the Melody Music Company of Evanston, Ill., which have one or more missing instruments of a selection, in order to allow the listener to join in the performance. This replaces eager-beaver young piano students who used to "race" Paderewski's recorded performance of the *Minute Waltz* as played on a hand-wound Victrola.

However, unless the turntables are in excellent control, the music played may be one-quarter of a tone different from the listener's instrument, and this can be a slight disadvantage to sensitive ears. Aside from this, the practice of ensemble playing is a valuable aid to the student.

• • •

(References from which the material was taken: "The Making of an LP," *by John Molleson in the Dec. 7, 1952 issue of the* New York Herald Tribune, *and* "Disk Prices Set by Recording Costs," *by John Briggs in the Mar. 21, 1954 issue of the* New York Times.)

Oil for 100 Years

Enough liquid fuel to meet the needs of all nations for a century lies in an oil-shale area of northwest Colorado. The area is somewhat smaller than Rhode Island.

This most fabulous known oil reserve, and how the government is seeking ways to tap it, were reported by Boyd Guthrie, chief of the oil-shale engineering branch of the United States Bureau of Mines.

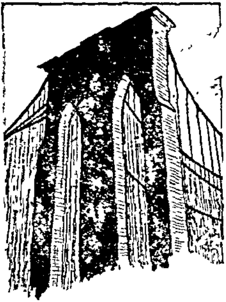
The 1,000-square-mile area is the richest section of the Green River oil-shale formation which extends into Wyoming and Utah and ranges in thickness from 500 to 2,000 feet.

Oil shale is a rock from which oil [illegible] reau near Rifle, Colo., Mr. Guthrie said. The gas combustion method, using a continuous, single-vessel, countercurrent, gravity-flow retort, proved to have many advantages over other methods.

In the system, the vapors are condensed into a fine stable mist within the retort. The products are cooled before being withdrawn from the vessel. A great advantage of the method is that the need for cooling-water, scarce in that semi-arid area, is eliminated.

But many problems remain to be solved, and just when an oil-shale industry will develop in the United States depends upon the costs of petroleum fuels, availability of foreign oil supplies, and further technological developments with oil-shale technique, he said.

Today, estimated costs for shale oil are only a little higher than average costs from petroleum. But before 1960, Mr. Guthrie predicted, costs will be equal.



wonders of the COMETS

by William B. Nash

DID YOU KNOW that a comet's tail doesn't always follow the comet? Sometimes the tail is in front of the comet. Sometimes it is riding along beside it, projecting from its side. And some comets have no tails at all.

The solved and unsolved mysteries about these glowing space travelers are both fascinating. To understand them, it is first necessary to investigate the anatomy of a comet. Astronomer Percival Lowell described this anatomy bluntly by referring to a comet as "a bag-full of nothing."

This was brought home dramatically to mankind when our planet earth went through the tail of the comet Lyrids in 1861, and through Halley's comet of 1910. The prediction that our planet would intercept the tail of Halley's comet caused near-hysteria in many parts of the world. People feared that poisonous gases would foul our atmosphere and choke out all life.

One enterprising man made a fortune selling comet pills The inhabitants of a town in Asia Minor prepared to get up to their necks in water. Churches overflowed with people praying for preservation. Relief and joy were unbounded when the great comet arrived and departed without a trace of harm to anyone

These gigantic celestial visitors which sail into our view, then leave us, perhaps not to return again for hundreds of years, are usually tens of thousands of miles in diameter, near the size of the giant planet, Jupiter. Sometimes they even exceed the size of the sun. It seems incredible that a collision between the earth and such a giant from space would not be a catastrophe, yet, upon investigation, it becomes apparent th

rial.

In the nucleus, or "head," of a comet—the area of its greatest density—no sizable body has ever been observed. When, in 1910, Halley' comet passed between the earth an the sun there wasn't the slightest evi dence of a shadow against the sun' disc.

Spectroscopic observati

shown that the material in comets consists of billions of small stones, which are concentrated in the nucleus and gradually thin out toward the edges. Surrounding these minute stones are quantities of various gases, called the "coma."

As yet, no way has been found to measure accurately the total quantity of matter in a comet, but any approximation currently accepted by astronomers asserts that the amount of material, spread over such a considerable volume, would measure very few particles per cubic mile of space.

Thus, if we met the nucleus of a comet head-on, we would probably see nothing more serious than a very intense meteor shower. If we passed through the tail the only result would be a brightening of the sky. Though some of the gases identified in the comets are poisonous, we have little to fear, because each molecule of the gas is separated from another like it by several miles!

Despite the magnificent brightness of some comets, they are not self-luminous bodies. Their brilliance comes from the sun and is both reflected by the tiny solid bodies, and absorbed and re-emitted by the gas molecules.

The tail of the comet does not begin to grow until the comet nears the sun, and has arrived at least inside the orbit of Mars. If we stood on Jupiter or any other planet farther away from the sun, much of the comet's beauty would be lost to us, for it would look like a stubby pollywog. But beautiful comet tails extending almost 200 million miles in space have been witnessed from the earth.

The length of such tails is the equivalent of more than twice the distance from the earth to the sun, and the width spreads to 15 million miles. A tail like this was the astounding appendage of the great comet of 1843, which will streak through space for 2,000 years before visiting our planet again. The famous 1910 Halley's comet with which we are most familiar, grew a tail 93 million miles long.

The tail of a comet always points away from the sun, like smoke drifting downwind from a campfire. Therefore, if a comet is on the part of its orbit departing from the sun, the tail points ahead of it like the illuminating beam of a flashlight.

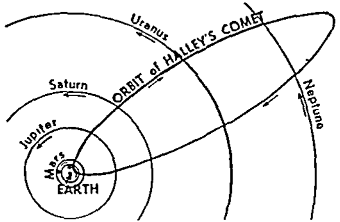
The reason for this was a riddle to astronomers until physicists, at the beginning of this century, showed that light will exert a pressure on tiny particles and will actually blow them away from the light source. Since this force is extremely small only the most minute particles and gas molecules are affected.

None of the material that is blown away ever gets back to the comet, and it is obvious that a comet as it nears the sun innumerable times cannot continue to produce an unlimited number of tails. This is why the "short-period" comets, which make more trips around the sun than the others, now grow such short tails. More than 800 known comets have periods of less than 12 years. The tail of Halley's comet, which reap-

pears about every 77 years, is still elegant, but a definite fading of its brightness has already been recorded.

Comets not only disintegrate in this manner, but have also been observed to break up into several segments.

What happens to comets when they disintegrate? Studies leave little doubt that they become meteor streams which move around the sun in much the same orbit as the parent comet. They reveal their existence when our earth's atmosphere collides with them and we see them as a meteor shower.



THE ORBITS of periodic comets (those which return to the vicinity of the sun) are elliptical. The diagram above shows the relative shapes of the orbit of Halley's Comet and those of our earth and its neighboring planets.

Where do comets come from? Astronomers would like to know.

Thus far, there is no evidence that any of the comets observed by man originate in interstellar space. It appears, from a study of the orbits and speeds of the comets which have come within the range of the unaided eye or the telescope, that none of them are traveling fast enough to escape the gravitational attraction of the sun.

How many comets exist in our solar system can only be approximated. Any reasonable guess makes the total somewhere in the hundreds of thousands

There have been many suggestions presented to explain their origin, but all are unsatisfactory to careful scientists

Do they represent the debris left over when the solar system was created? We cannot be certain of this since we can only conjecture about the way our solar system was formed. Also the small stony particles making up the comets do not, if widely scattered in space originally, have the tendency to aggregate into clusters. In addition, their orbits are at all angles, while our planets move in orbits of similar plane.

It is doubted that they were captured from dust clouds in interstellar space by our sun, as some suggest, and it seems likely that others are incorrect when they theorize that comets were spouted from great volcanoes on Jupiter or Saturn. If particles were moving fast enough to escape the powerful gravity of huge planets they would also be eling fast enough to ignite in the

tion of their dense atmospheres and be consumed.

The sun's gravity is too great to permit the escape of material shot outward by great solar prominences, and it is difficult to imagine the collision of two asteroids resulting in the creation of a comet.

As of now, no one knows when, how, or where the comets were formed. Perhaps with the application of our newest telescopes, cameras and advancing methods, we shall soon know.

In the meantime, if you ever see a bright fuzzy spot in the sky with a luminous tail, report it to the nearest amateur or professional astronomer. You may have a comet named after you!

Germ Thrives on Poison

A germ that thrives on potassium cyanide, deadly poison to man, animals and most forms of life, has been discovered.

Experiments were made at Britain's Water Pollution Research Laboratory to determine the fate of potassium cyanide in sewage being treated This resulted in the isolation of the bacterium that was capable of growing on silica gel medium containing only the poisonous chemical as a source of nitrogen and carbon.

The scientists, G. C. Ware and H. A. Painter, found that ammonia is produced from the cyanide by the growth of the organism, but the fate of the carbon has not yet been traced

The organism has been provisionally classed among the Actinomycetaceae, in which the organism that produces streptomycin is also placed

The organism consists of Gram-positive branching filaments approximately

millimeter in diameter after incubation for seven days at 28 degrees Centigrade. Some of these colonies can utilize more than half a milligram of cyanide a day.

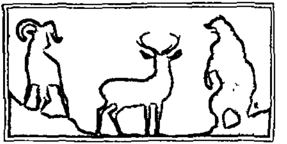
Yellow Fever Vaccine Closest to 100-Percent Efficiency

Of all vaccines, including probably the Salk polio vaccine, the yellow fever vaccine comes closest to being 100 percent efficient.

Yellow fever, like polio, is caused by a virus. But the yellow fever vaccine, unlike the Salk polio vaccine, is made from live virus The Salk polio vaccine is made from killed virus.

The yellow fever vaccine must be freshly prepared and the persons giving it must be licensed to do so. The person successfully vaccinated actually gets a very modified form of the disease. With this, as with smallpox vaccine, doctors can tell whether there was a "take" by the reaction, such as fever in the case of the yellow fever vaccine.

America's BIG-GAME Animals



Near a stream in eastern Tennessee, now known as Boone's Creek, Daniel Boone carved into a tree, "D. Boon cilled a bar on (this) tree in the year 1760."

Modern-day Daniel Boones can still find "bars" aplenty in Tennessee, and in 34 other states as well. For a time when most Asian and African nations are worrying about a rapidly occurring scarcity of their own big-game animals, the United States is enjoying more than adequate numbers.

Most persons, conditioned by the movies and novels, associate big game with trackless jungles and lions and tigers. But American outdoorsmen will tell you that the grizzly or bighorn sheep can more than match their old-world counterparts.

Most big game in the United States is divided into two categories. Those hunted for food and fun, such as the deer, bear, mountain goat and moose; and those hunted because they are a menace to both man and domestic animal, such as the mountain lion and timber wolf.

There is little danger of any of the nation's big-game species passing into extinction. Although only 45 native caribou were reported in the U.S., the species is being perpetuated in Canada.

So numerous are big-game animals that the latest survey, the 1953 census of the 48 states, showed that there were an estimated 11,200,000 big-game animals roaming the American countryside.

The Fish and Wildlife Service surveys America's big game regularly.

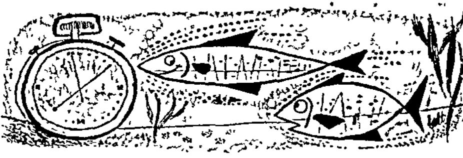
The list includes such well-known animals as the moose of which there were approximately 14,500 before the 1953 hunting season (latest figures available); elk, 325,000; white-tailed deer, 5,300,000; black bear, 170,000; mule deer, 3,240,000; bighorn sheep, 20,000; mountain goats, 14,000; and wild turkeys, 465,000.

Grizzlies numbered 950, the majority being found in Montana. From the millions of bison that roamed the Plains in early American history, the Survey lists 6,600 bison today. Although they are not hunted like the others, they are considered big game. The pronghorn antelope, of which the cowboy sings, numbered 360,000. Peccaries, or wild pigs, numbered 135,000.

Mountain caribou, the rarest of the listed big-game animals, totaled 45, with 35 in Idaho and 10 in Washington. The majority of the big-game animals are to be found in 17 western states. Wyoming offers the widest variety of big game with 11 different animals. New Mexico, Idaho and Montana each have 10. California, on the other hand, has the greatest number of individual animals, 1,275,000. Rhode Island, smallest state, has the fewest big-animals: 600 white-tailed deer.

—*Howard*

Science



HOW FAST DO FISH SWIM?

by David Gunston

Condensed from Salmon and Trout Magazine

FISHERMEN frequently fall into the error of overestimating the speeds of fish. The reel screams out its line, the capture struggles mightily and plays cunningly, and all the time appears to swim about faster than is actually the case. Nevertheless there are many kinds of fish which can put up a good speed, even when not hooked, and the whole subject of fish speeds is fascinating.

To begin with, no creatures are such masters of their natural element as are fish—not even birds, with their apparently effortless soaring and gliding. A fish can remain motionless for as long as it likes; it can move forwards or backwards an imperceptible degree; it can spurt forward [illegible] ideal for swift, sinuous movement, and its underwater streamlining is perfect, as man recognizes when he makes submarines and torpedoes. The simple "jet propulsion" with streams of water ejected swiftly backwards through the gills, the molded body shape and bullet-shaped head, the smooth-surfaced inset eyes, the scales and the tapering rear quarters are all admirably suited to speedy progress through the water.

The resistance of water, by the way, is something like 700 times that of air, so the really high speeds achieved by fish are little short of miraculous.

It was formerly thought that the fins, particularly the fin nearest the tail, and the tail itself, were the sole means of locomotion, but experiments have shown that a fish without tail or fins is far from helpless. The chief method of progression is through the rippling undulation of the fish's body, aided by the streams of water from the gills.

The other organs are useful as

Salmon and Trout Magazine (May '55), London, England

steering devices, balancers, brakes and aids to sudden movement, while the swim-bladder inside all fish, a kind of sac containing gas lying just above the gullet, acts as a sort of hydrostatic lifebuoy, adjusting the gas contents according to the degree ⁻f water pressure at varying depths. 'hus a fish can move quickly up or own in the water without experi-ncing any discomfort at the sudden hanges in external pressure.

Both the shape and tail formation f fish are good guides to their owers of speed. The fastest fish ave long, cigar-shaped bodies, road rather than high: whereas fish with short, high, laterally-com-ressed bodies (the perch shape, as pposed to the salmon shape) are slower-moving. Those fish with deep-y forked tails are nearly always the fastest over long distances, and those with square or rounded tail patterns are usually slow movers, although most of them are able to make short dashes at high speed if the need arises.

It is extraordinarily difficult to get reliable proof of fish speeds, for there are many obstacles in the way of checking underwater movements—some of which may be startlingly sudden—with any degree of accuracy. Fish speeds have been recorded with a variety of devices: by stop-watch; "fish-o-meter" attached to a rod to register the speed at which the line *is run out; a device in which tank* fish are harnessed with a fine silk cord which unwinds over a large pulley, actuating a sensitive relay once every revolution; by taking a film of swimming fish and working out their speed by comparison of the varying positions on each frame of the film; by timing a swimming fish from the known speed of a ship which it passes in a recorded time; even by calculating the speed of the current in a river and then working out the minimum speed a fish must achieve to make headway against it.

A French scientist, Prof. A. Magnan, using the third device mentioned, has done a lot of work in this field, but most of his findings relate to the normal speeds of fish, rather than to their absolute maximum speeds. He found pike, dogfish, salmon, sturgeon, tunny and blue shark to be among fish with the fastest typical speed. Some speeds he recorded are: salmon, 11 miles per hour; tunny, (our Atlantic Coast tunny is called horse mackerel) 14 mph; and blue shark, 24 mph. All of these are normal, rather than emergency, speeds.

Salmon have attracted more speed investigators than any other fish, and a French expert who coaxed fish along a specially built track in the River Vienne found the salmon an easy first on the track, at about 18 mph The highest recorded speed for a salmon is 25 mph, although some authorities claim that it has been known to swim even faster.

All fish speeds, by the way, should be regarded against the world speed *record for a human swimmer,* is a trifle more than 4 mph ⁽ distances.

Bonefish have l at 22 mph. Zane Gı

novelist, tells how he once hooked one and ran towards it along the bank. In the time he took to cover 50 feet the fish had reeled out 400 feet of line. Assuming Grey's speed to be only 5 mph, the fish would appear to have reached 40 mph in a very short burst.

The fastest fish of all without any doubt is the sailfish, a variety of swordfish. It has been known to take out 100 yards of line in only 3 seconds, a speed of nearly 70 mph, and anything over 60 mph is usual for these creatures in a sudden spurt of colossal energy and anger.

Tunny also rush at a good speed, recorded as about 44 mph maximum by a "fish-o-meter;" and a tunny that does not spurt off at 40 mph or over when it first feels the hook is an unusual catch.

But for sheer impact of speed, sometimes directed at a boat, the thrust of a swordfish takes some beating. It has been shown that to drive the rapier of a swordfish through some 20 inches of hardwood sheathed with copper and often faced with oak takes a driving force at the moment of impact of at least 60 mph.

The wahoo has been timed by stop-watch to travel 200 yards in 11 seconds when it's hooked, which is an average speed of just over 37 mph, while the fighting tarpon and the mako shark can both reach a maximum speed of about 35 mph, sometimes hurling their bodies completely out of the water. The other really fast fish is the dogfish, to which a spurt of 30 mph comes easily.

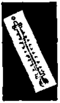
Among the smaller species, th trout follows the salmon with a maxi mum speed of about 23 mph, an more than one stop-watch has regis tered a pike's speed at 20 mph. Devil fish at 14 mph and bass at 12 mph both maximums, are speedy adver saries, and even a minnow can swir at over 9 miles an hour, accordin to stop-watch calculations.

Here are some other authenti speeds recorded for species of inter est to anglers: perch, 10.2 mph roach, 10 mph; barbel, 11 mph dace, 9.3 mph; carp, 7.6 mph; mu let, 8 mph; eel, 7.5 mph; tench an stickleback, both 7 mph; chub, mph.

It is worth remembering that eve this last speed is above the maximu for a human swimmer and is as fa as it is possible to walk without ac tually running. By way of compar son, the bream goes at only 1½ mph, although the picture presente by an octopus darting about at mph runs contrary to the generall accepted opinion that these devilis creatures are slow-moving and slug gish by nature.

If our authenticated records c fish speeds over short distances ar all too few, those covering long per ods and distances are even rarer. marked eel, however, is known t have swum 750 miles in 93 day which gives it an average speed c around 8 miles a day, and a salmo has been known to swim at over 6 miles a day for more than 10 day in succession. The usual daily mile age for a salmon in the sea has bee estimated at nearer 25 miles.

FREEZING TO LIVE



by Jane Stafford

Condensed from Science News Letter

MORE AND MORE PATIENTS these days are getting cold treatment from doctors. Theirs is not a case of getting the cold shoulder. The treatment is really cold in the temperature sense. They are being almost frozen—to live.

Some of them are small children born with defective hearts that need "blue-baby" and other kinds of operations to mend them. Others are grown-ups with tumors, called aneurysms, of blood vessels. Servicemen with leg and arm wounds will benefit from the new developments in cold treatment For the future, there is hope that the experience of some patients in freezing to live will show how to save fliers forced down in icy seas or men on arctic duty marooned in blizzards away from base.

The patients do not feel chilled. They are put gently to sleep before the cold is turned on. They do not awaken until they are warm again. While they are having their frosty nap, surgeons have time to perform intricate operations that are practically bloodless, even when the operations are done on veins and arteries and the heart itself.

The time factor is the big gain from this cold treatment. When a surgeon cuts into a large blood vessel or the heart he must stop the blood flow temporarily. But the blood carries oxygen. And body tissues cannot live long without oxygen Some can take oxygen lack for longer periods than others But for vital organs such as the brain, liver and kidneys the crucial period is measured in minutes. The human brain dies if deprived of oxygen for more than four or five minutes. The liver is hopelessly damaged by about 20 minutes of oxygen lack. Kidneys will not return to functioning if blood is kept from them for 45 minutes.

One way of sparing tissues from suffocation is to reduce their demand for oxygen. Years ago anesthetists recognized, in a backhanded way that reducing body temperature would reduce oxygen demand. W they recognized first was reverse of this.

A patient brought to

room for an emergency appendix operation did poorly under the anesthetic if he was feverish. This was because the need for oxygen is increased 7 percent for every degree of Fahrenheit rise in body temperature. A patient with a temperature of 101.6° F. would need a 20-percent increase in oxygen.

Such patients could not get by on the oxygen in the air of the room. So anesthetists faced with such patients would turn on the oxygen tank to give extra oxygen to the patient. Air-conditioning for operating rooms helped when it came along. So did ice packs and putting ether on the skin.

These measures helped feverish patients by reducing the body's demands for oxygen. Next step, though it was not taken immediately, was to reduce oxygen demand in patients with normal temperatures by dropping their temperatures below normal.

The idea was to make the patient something like the hibernating ground squirrel and ground hog setled for the long winter's nap. In true hibernators, the breathing and pulse almost stop and the temperature drops to a point very little above that of the animal's environment. The animal's body apparently has its oxygen needs reduced to a very low level and yet it can survive.

Some Canadian scientists have been studying hibernating ground hogs in the hope of finding the secret of their survival with such low amounts of oxygen. Meanwhile they and doctors elsewhere have been deliberately chilling patients many degrees below normal body temperature of 98.6° F.

The limit to which patients have been chilled has been about 75° F. Below this, complex chemical changes occur which may become irreversible. Theoretically, if patients could safely be cooled to about 53 or 54° F., their body tissues would make no demands for oxygen.

The 75°-limit, however, has enabled many life-saving operations to be performed. One case was that of a young man with a blood vessel tumor of the aorta. This tumor, or aneurysm, was in the arch of the aorta and involved the main blood supply to the body. Each time the heart pumped, the balloon-like sac on the blood vessel wall was in danger of blowing out. Unless it could be removed and the blood vessel wall stitched together, the patient's life was in constant danger, since a blow-out of the sac would mean a swift and fatal hemorrhage.

To remove this patient's aneurysm required clamping the aorta shut between the heart and the aneurysm. This would stop all blood flow through the body except to the right arm and right half of the brain. The needed surgical repair could not be done in the four or five minutes that the aorta could be clamped shut at normal body temperatures. So the anesthetist chilled the patient, the surgeon performed the operation, the patient was warmed and 11 days later walked out of the hospital, a well man.

Equally dramatic was the case of

a man past 70 years of age with a bad heart who developed an aneurysm. He needed to have the aneurysm removed and a piece of blood vessel grafted to replace that cut out. The surgeons were not sure how long this would take. They feared that with ordinary methods interruption of blood supply to the lower part of the man's body might have so starved the tissues of oxygen that his kidneys might have gone bad or his legs might have become gangrenous and have to be removed. So they chilled him before operating. Today this 70-year-old with the bad heart is still alive and "running around"

Refrigerating patients, inducing hypothermia (low temperature) doctors call it, can be done by many methods. At the Army's Walter Reed General Hospital in Washington, D. C., it is done by an "overgrown water bottle." This is simply a rubber mattress through which ice water can be circulated. The sleeping patient lies on the mattress and is cooled to the desired degree.

At the University of Colorado School of Medicine, Denver, the patient is cooled by being put in a tub full of ice water, warmed to normal by immersion in a tub of warm water.

European scientists run blood from an artery through a plastic tube packed in ice and back to a vein.

George Washington University scientists in Washington, D. C., run sterile cold salt water into the patient's chest, warm him up by running sterile warm salt water into the chest cavity. This is for patients who will have operations on the heart and whose chests will be opened anyway.

Doctors at Guy's Hospital in London suggest putting a small balloon into the patient's stomach through his throat, running ice water into it to cool the patient and hot water to warm him. The method succeeded in reducing high fever in a very sick baby and should, the doctors believe, be equally useful for patients having heart and great blood vessel operations.

Refrigerating human patients got its modern start in 1937 when Philadelphia doctors tried it for hopelessly sick cancer patients. The theory was that the low temperatures would slow the growth of the cancer cells Studies of chick embryos had shown that the growth of young, embryonic and fast-growing cells was checked as temperatures were reduced Patients were kept in "frozen sleep" at 75° F. for from 24 hours to 8 days, with relief of pain and suffering

During World War II, refrigeration anesthesia was used for arm and leg wounds The arm or leg was packed in ice and a tourniquet applied for two hours or so. After that, the needed operation could be performed without further anesthetic.

"Frozen sleep" is, however, only semi-hibernation. And while it is helping patients get vitally needed surgery, it is different from the chilling that is experienced in
exposures to very low
The patients are gently
before the chilling. This
from the stressful
which can be fatal. F

servicemen who might be exposed to freezing, survival might be possible if the stress could be prevented. The Chicago woman who recovered after being frozen stiff in an alley was "well anesthetized," according to one authority, by alcohol she consumed before she froze.

Various drugs are now being experimented with in the hope of finding one that could prevent the stress state in freezing. Then, perhaps, men likely to be lost in very cold regions could carry with their emergency rations a supply of hibernating pills. Swallowing a few of these might enable them to have a ground hog's nap until rescuers arrived.

Roman Ruins: Clue to Water

When in Tunisia, do as the Romans did This is what today's North Africans do to find fresh water and plant new crops, a French engineer has disclosed.

Many wells and hydraulic works are located each year by finding Roman ruins along the Mediterranean, Jean Tixeront, chief engineer of public works in Tunis, told the International Arid Lands Meetings. Ancient artifacts offer another clue to the location of underground water. Mr. Tixeront reported that olive trees were planted in the coastal Sfax area only after very old oil-presses were found there.

Electronic Brain Takes Up Juggling

Even a juggler can be replaced by a machine.

While its more serious cousins grind out answers to the ponderous problems of physicists and mathematicians, an electronic "brain," made in the U.S.A., added some vaudeville color at the recent German Industries Fair.

The "electronic juggler" quivers, jiggles and jumps until the attached servomechanism gives the cue that the three-foot steel rod the "juggler" holds is in perfect balance. He is then ready to begin his "act."

The juggler stands holding the rod in perfect balance without support or connective device of any kind. It can keep this up indefinitely.

Engineers point out that this demonstration of continuous juggling symbolizes the ability of the computer to perform other automatic control feats for industry. Such devices may free human workers of the future from many tedious and repetitive tasks in the "push-button" factories of the future.

The electronic juggler was designed by Reeves Instrument Corp., and was part of the U. S. Department of Commerce's exhibit.

JOHN HARRISON

Inventor of the Marine Chronometer

by Anthony Benis

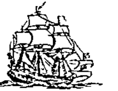
Condensed from Think Magazine

ON FEBRUARY 11, 1493, Columbus was returning from his great voyage of discovery. That evening, from the deck of the little *Nina*, he took the altitude of the pole star with his cross-staff and, after some computation, knew his latitude.

But his longitude? That was beyond his skill to determine, as it would be beyond men's skill for another two centuries. Columbus knew his ship's course and could guess at its speed, but his dead reckoning was so uncertain that he could but hope that he was nearing the Azores. When the first landfall did prove to be these islands, it was but a fortunate guess that had led him to predict it.

More than 200 years later, in 1707, the British Admiral Sir Cloudesley Shovel was returning from Gibraltar with his fleet after an attack on the port of Toulon. As Comdr. R. T. Gould recounts in his book, *The Marine Chronometer*, "he had had cloudy weather practically during the entire passage, and after some 12 days at sea, he took the opinions of his navigators as to the position of his ships. With one exception (which afterwards proved correct) their reckonings placed the fleet in a safe position some distance west of Ushant, and he accordingly stood on; but the same night, in fog, they ran on the Scillies. Four ships were lost, and nearly 2,000 men, including the Admiral himself."

Think Magazine (May '55), 590 Madison Ave., New York 22, N. Y. Copyright 1955 by International Business Machines Corp



When a ship goes from north to south, or from south to north, there is a change in the apparent altitude of the heavenly bodies, and since such altitudes are easily observed at sea with considerable accuracy, the position of a ship north or south can be easily established by observations combined with the tables of celestial bodies given in every nautical almanac. This is the latitude.

But when a ship sails east or west, no change is produced by such motion in the apparent altitude of t[illegible] heavenly bodies. The rotation [illegible] earth will bring the stars [illegible] ship's meridian every day [illegible] different time each day [illegible] moves east to west [illegible]

For this reason, a precise timekeeper is one of the easiest methods by which one can determine longitude.

As early as 1530, Gemma Frisius, a Dutch mathematician, had suggested the carrying of a clock on board ship which would give the standard time of the port the ship had left, and the longitude would then be found very simply by comparing it with local time found by observation, as a minute of time would correspond to 15 minutes of longitude At the end of a six weeks' voyage, if it were required to know the longitude within half a degree, the error of the timekeeper should not amount to more than two minutes in that period, or approximately three seconds a day.

But it should be remembered that before 1700, a ship captain's watch had no second hand, nor even a minute hand. What he had was an onion-shaped ticker, perhaps in a very precious case, but with the hour hand only, and its precision varied within 15 to 30 minutes every day.

It was the disaster to Shovel's fleet which led the British Parliament, in 1714, to promulgate the act known as 12 Anne., cap. 15, an act providing "a publick reward for such person or persons as shall discover the longitude at sea," and offering 20,000 pounds sterling to anyone discovering a "proper method for finding the said longitude." Whoever aspired to this enormous reward (which would correspond to not less than $2,000,000) would have to construct a timekeeper, the average daily error of which would not be more than the above-mentioned three seconds a day.

However, not only in 1530, but as late as 1700, a watch which would keep time with such accuracy was unheard of, for the sand glasses and clumsy portable watches which were the only available timepieces for ship use could not be relied on to keep time within three minutes a day, much less three seconds.

Queen Anne's bill established a Board of Commissioners comprising the Lord High Admiral, the first Commissioner of the Admiralty, the Speaker of the House of Commons, the President of the Royal Society, and the Astronomer Royal, in addition to seven admirals and three professors of mathematics, to determine the winner of the award. These personages, known as the Board of Longitude, from 1714 until 1828, disbursed the equivalent of some $10 million, and became "the immediate and accessible prey of every crank, enthusiast, fanatic, swindler and lunatic in or out of Bedlam."

Then a young son of a Yorkshire carpenter appeared on the scene, and by his genius won himself not only a fortune and immortal fame, but also the honor of having laid the basis of modern navigation.

• • •

JOHN HARRISON, inventor of the first successful marine timekeeper and winner of the 20,000-pound award, was born in 1693. By the time he was 22 he had built his first precision clock and soon began de-

veloping ideas of his own In 1726, he had already made a clock which did not vary more than one second a month. This would, of course, be amply sufficient to win the longitude prize, but these timepieces were tall case clocks with long pendulums and, decades earlier, the famous Dutch scientist, Christian Huygens, (*see* SCIENCE MILESTONE: November, 1953) had proved that a pendulum clock was hopelessly unsuited to sea use because in anything but a flat calm its going became most erratic.

For his timepiece Harrison in-ented a precision escapement, called he grasshopper escapement, and in 735 he produced his first machine, he famous Number One, a large lock controlled by two balances in-tead of a pendulum. The most re-narkable features of it were the first ttempt for the compensation of the ffects of heat and cold, and an ex-raordinary number and variety of levices to eliminate friction. As we now today, friction and changes of emperature are the two perennial enemies of precise timekeeping.

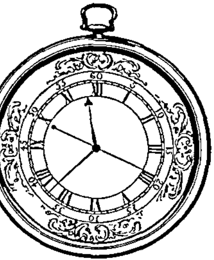
Number One was a heavy appa-atus weighing 72 pounds. In 1735, he Board of Longitude sent it on a rial voyage to Lisbon. It behaved well but not accurately enough to warrant a reward. However, the Board gave Harrison 500 pounds to assist him in making a better timepiece.

Progress was made in 1739 with Number Two. Then, for 17 years, Harrison worked on his Number Three. By 1757 this timepiece, which was still a ponderous machine, was

JOHN HARRISON
(1693-1776)

ready for trial. But Harrison, the perfectionist, was not satisfied

He had met with considerable difficulties on the part of the Board. The Astronomer Royal and his friends favored other methods for finding longitude, in preference to the construction of a precise timekeeper. In particular, they tended to believe that longitude would be better found by lunar observations. For this reason they attached much importance to the so-called lun tables, today completely aban and treated Harrison's ac ments as a stroke of luc Commissioners of the important people —



"NUMBER FOUR"—John Harrison's world-famous marine timekeeper, the first precision chronometer. Completed in 1759, it was about four inches in diameter, and had a large silver case.

ernment officials, admirals—and, "John Harrison was a nonentity."

ground that various conditions had yet to be satisfied. It was then that in 1759 Harrison dramatically abandoned his large and heavy machines, the going of which could be questioned, and produced his Number Four, the most famous watch in the world. In fact, that celebrated mechanism is nothing but an enormous silver watch about five inches in diameter. It has an improved escapement and a most ingenious remontoir (mainspring regulating device) of a fascinating construction. "The mechanical intelligence with which the claw unerringly selects the right pin, disengages itself and returns to meet the next is," as the Marquis of Worcester said, "a thing most incredible."

"Into the making of Number Four, a masterpiece weighing less than the brain that conceived it, went 50 years of self-denial, unremitting toil and ceaseless concentration."

• • •

In April, 1761, Harrison requested a trial of his timepiece at sea. In consequence, H.M.S. *Deptford* sailed from Spithead on November 18, 1761, and set sail for Madeira. On the ninth day after leaving sight of land, the ship's longitude, by dead reckoning, was 13 degrees and 50 minutes west of Greenwich, but by Number Four it was 15 degrees and 19 minutes west. Capt. Dudley Digges, the skipper, was inclined to prefer dead reckoning and offered to bet Harrison's son, who made the voyage, 5 to 1 that the instrument was wrong. Young Harrison maintained the timekeeper to be correct, stating that if Madeira were correctly marked on the chart they would sight it on the following day. Porto Santo of the Madeira group was sighted the next morning.

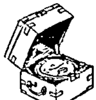
Arriving in Jamaica, the timepiece was found to be only five seconds slow, corresponding to an error in longitude of only 1¼ minutes. Accordingly, under Queen Anne's Act Harrison came within the requirements for the great prize. The Board refused to give the award, and a battle royal ensued. It was settled only by the intercession of King George II and Charles James Fox

who vigorously supported Harrison's claims.

Finally, at the age of 80, Harrison obtained the immense financial award, "and so the humble Yorkshire mechanic," says Comdr. Gould, "who had already shown himself a master horologist, proved more than a match for the eminent Board and his powerful rivals " Since that time, no one has questioned his achievement in constructing a precision watch on which, for 150 years, every ship's captain on the seven seas has relied. Harrison died in London on March 24, 1776.

• • •

When, during World War II, a adio silence was established, depriving the Allied fleets of the time sigals necessary to establish the preise hour, there was a rush in all the navies of the world to obtain precision marine chronometers, none of which would be possible today without the genius of John Harrison. This man, who was anything but a navigator, but was rather a craftsman with a loupe in his eye and pliers



in his hands manipulating tiny bits of tempered steel, avenged Shovel and all the other victims of shipwreck, whose death could be traced to the ignorance and lack of precise instruments maintained among hapless sailors by the noble Sea Lords.

Future Marvels of Electronics

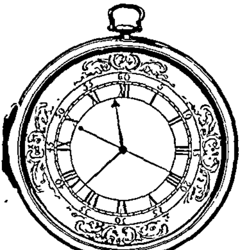
Advances in communications based on current laboratory developments will bring into use picture-frame television, machines and systems that respond to the spoken word, and electronic systems capable of scheduling production and controlling manufacturing and commercial processes, Dr. E. W. Engstrom, executive vice-president, research and engineering, Radio Corp. of America, said. He predicted:

1. An entirely new type of television receiver. Today's picture tube will be replaced by a thin screen hung in a picture frame on the wall and controlled from a small box elsewhere in the room

2. A major advance in the field of personal communications. Instantaneous contact between individuals anywhere in the country—and perhaps in the world—at any time and place

3. We can look for machines and systems which will do our bidding in response to the spoken word.

4. Data-handling machines and systems able to analyze marketing and sales data, schedule production, ord materials, control manufacturin esses, and schedule delivery o products.



"NUMBER FOUR" — John Harrison's world-famous marine timekeeper, the first precision chronometer. Completed in 1759, it was about four inches in diameter, and had a large silver case.

ernment officials, admirals — and, "John Harrison was a nonentity." He had to struggle against the doubts of the Board which, even after his fulfilling the conditions of the Act of 1714, withheld the award on the ground that various conditions had yet to be satisfied. It was then that in 1759 Harrison dramatically abandoned his large and heavy machines, the going of which could be questioned, and produced his Number Four, the most famous watch in the world. In fact, that celebrated mechanism is nothing but an enormous silver watch about five inches in diameter. It has an improved escapement and a most ingenious remontoir (mainspring regulating device) of a fascinating construction. "The mechanical intelligence with which the claw unerringly selects the right pin, disengages itself and returns to mee the next is," as the Marquis o Worcester said, "a thing most in credible."

"Into the making of Number Four a masterpiece weighing less than the brain that conceived it, went 5 years of self-denial, unremitting toi and ceaseless concentration."

• • •

In April, 1761, Harrison requested a trial of his timepiece at sea. In consequence, H.M.S. *Deptford* sailed from Spithead on November 18, 1761, and set sail for Madeira. On the ninth day after leaving sight of land, the ship's longitude, by dead reckoning, was 13 degrees and 50 minutes west of Greenwich, but by Number Four it was 15 degrees and 19 minutes west. Capt. Dudley Digges, the skipper, was inclined to prefer dead reckoning and offered to bet Harrison's son, who made the voyage, 5 to 1 that the instrument was wrong. Young Harrison maintained the timekeeper to be correct stating that if Madeira were correctly marked on the chart they would sight it on the following day. Porto Santo of the Madeira group was sighted the next morning.

Arriving in Jamaica, the timep'e was found to be only five secor slow, corresponding to an error longitude of only 1¼ minutes. A cordingly, under Queen Anne's Ac Harrison came within the requir ments for the great prize. The Boa refused to give the award, and battle royal ensued. It was settle only by the intercession of Ki George II and Charles James Fo

who vigorously supported Harrison's claims.

Finally, at the age of 80, Harrison obtained the immense financial award, "and so the humble Yorkshire mechanic," says Comdr. Gould, "who had already shown himself a master horologist, proved more than a match for the eminent Board and his powerful rivals." Since that time, no one has questioned his achievement in constructing a precision watch on which, for 150 years, every ship's captain on the seven seas has relied. Harrison died in London on March 24, 1776.

• • •

When, during World War II, a idio silence was established, depriv ıg the Allied fleets of the time sig als necessary to establish the pre ise hour, there was a rush in all the navies of the world to obtain precision marine chronometers, none of which would be possible today without the genius of John Harrison. This man, who was anything but a navigator, but was rather a craftsman with a loupe in his eye and pliers

in his hands manipulating tiny bits of tempered steel, avenged Shovel and all the other victims of shipwreck, whose death could be traced to the ignorance and lack of precise instruments maintained among hapless sailors by the noble Sea Lords.

Future Marvels of Electronics

Advances in communications based n current laboratory developments vill bring into use picture-frame televiion, machines and systems that repond to the spoken word, and elecronic systems capable of scheduling roduction and controlling manufacuring and commercial processes, Dr. E. W. Engstrom, executive vice-presilent, research and engineering, Radio Corp. of America, said. He predicted:

1. An entirely new type of television receiver. Today's picture tube will be replaced by a thin screen hung in a picture frame on the wall and controlled from a small box elsewhere in the room.

2. A major advance in the field of personal communications. Instantaneous contact between individuals anywhere in the country—and perhaps in the world—at any time and place.

3. We can look for machines and systems which will do our bidding in response to the spoken word.

4. Data-handling tems able to analyze sales data, schedule materials, control ma esses, and schedule products.

flow of hydrogen, the chlorine atoms in the iron chloride are allowed to unite chemically with the hydrogen at a certain precise rate. This leaves unattached atoms of iron, which 'migrate' slowly toward each other and deposit one upon another in perfect arrangement Thus, billions of iron atoms 'grow' without any observable defects into a single perfect crystal of pure iron, exactly square in cross section, and often attaining a length of 2 inches."

Micromachine Invisible Holes

Minute holes so tiny they are invisible can be made in metals with a new technique for machining by etching in an electrically conducting solution

Doctor A Uhlir, Jr, of Bell Telephone Laboratories told an American Physical Society meeting that flow of current in the solution was confined to a particular spot by a nonconducting partition, which can be a glass tube with a tip no larger than 1 micron in diameter.

A micron is the thousandth part of 1 millimeter. (About 25 millimeters make 1 inch).

A variety of shapes can be produced by moving the tip with respect to the metal being etched Plating with metals at a particular tiny point has also been accomplished with the technique.

—*Science Service*

Shoots the TV Commercial

Zenith Radio Corp. demonstrated a new kind of television set that uses a flash beam from a small pistol-shaped gadget without wires to turn the set on or off, change channels, or cut out the sound of long-winded commercials.

The flash beam (which is harmless to humans) does all the work—no dangling wires or connecting cords are needed. All the viewer has to do is shoot the flash beam from a little hand pistol across the room at a sensitive window on the corners of the set. The flash beam shining in the lower left hand corner will turn the set on or off. Channels are switched through the upper two sensitive windows; the one in the left corner turns to channels that are counter-clockwise; the upper right corner window changes channels clockwise. A beam striking the lower right hand window effectively tunes out commercials. Another touch of the flash gun brings the sound on again when the commercial is finished and the program returns.

New Wire Coating Will Permit Smaller Motors

A new silicone-modified enamel for electrical wires has been developed that can stand higher temperatures for longer periods of time than any non-silicone enamel.

The insulator is expected to permit development of smaller electric motors with greater power.

Tests at the Westinghouse Research Laboratories showed that a motor having wires coated with the new polyester-type enamel can operate continuously for 10 years at a temperature of 325° F. without damage to the insulation. This is equivalent to normal operation of a refrigerator motor for 30 years or a washing-machine for about a century

X-Ray Machines in Action

For the first time, the inside of an automobile or airplane engine can be seen and studied as it operates The instrument for doing this was developed by the National Bureau of Standards, Uncle Sam's house of science

X rays changed into light by an inch-thick crystal show the moving parts within the engine The crystal is made

of sodium iodide, a close relative of common table salt, which is sodium chloride. The crystal, however is a solid, 1 inch thick. It looks much like a highly polished hand mirror without a handle

The visible light emitted by one side of this crystal faithfully reproduces the X-ray pattern hitting the other of its two flat surfaces The X rays are produced when electrons, speeded up to an energy of 50 million electron volts, are aimed at a metal target. The X rays which are emitted by the target are beamed through the engine

The visual image issuing from the crystal can be detected in several ways It can be seen by eye, if proper precautions against radiation are taken It can be photographed with an ordinary camera. Or the image can be viewed on a remote television screen, transmitted here by a TV camera, thus eliminating danger from radiation.

Using this TV arrangement, scientists can make a rapid inspection for flaws as the engine operates With a suitable timing mechanism, the system can be hooked up for stroboscopic studies of moving engines, "stopping" them at any point in their cycle.

The technique was devised by Dr. John S. Pruitt of the Bureau of Standards staff. Using it, X-ray images seen through as much as 18 inches of steel, or 7½ feet of concrete, can be continuously displayed

Theaters May Get Film by Telephone

In the not-too-distant future, motion picture theaters will be able to get their new films by telephone writes Robert S. Kleckner in the *Chicago Sun-Times*.

However, they won't be the kind of film now shipped to the show places by express or mail in round metal l

A development from the David Sarnoff Research Center of Radio Corp. of America will make possible the reception of motion pictures, either in black and white or color, by magnetic tape recorder

It will result in savings of transportation and in film costs, since the tape can be erased and re-used many times

The magnetic tape recorder for sight as well as sound already is out of the laboratory and is being field-tested by RCA scientists as well as the National Broadcasting Co What is put on the tape can be speedily reproduced on any number of other tapes, preserved indefinitely or erased quickly.

One laboratory official said:

"It will be possible by telephone wires to send 'prints' to scores of theaters from a central distribution point at the same time"

Another new development coming out of the research center is an electronic refrigerator without any moving parts, with a life apparently indefinite

A French physicist, Jean Charles Peltier, more than 100 years ago learned that an electronic current passing through a juncture of two dissimilar metals caused a drop in temperature at the junction. Modern research men, investigating possibilities of electronic refrigeration, developed new alloys capable of achieving a far greater drop in temperature than any substances found in nature.

The freezing and cooling are accomplished by numerous tiny junctions of these new alloys through which an electric current is passed.

The practicability of which can be extended to ing — already has been the scientists say, al still are necesary for the market.

Radar Gets Colorful

An experimental color-radar set developed under Navy contract has been demonstrated in operations at the Washington National Airport.

The color model showed airplanes as bright orange dots moving over land areas etched out in pale chartreuse.

Its developers said a third color could be introduced without great technical difficulty.

The color is made possible by the basic principles of color television.

The standard set produces the same colorless "blip" for airplanes traveling at all altitudes. The color set can be rigged so that planes at high levels appear on the scope in orange, those at low altitude in green.

Or it could be made capable of depicting friendly and enemy planes in contrasting colors. — *Russell Baker in The New York Times*

Foreign-Exchange Calculator

While traveling in 16 European countries listed on a handy quick-reference chart a tourist using a new "Instant Calculator" of foreign exchange may be relieved of anxiety, miscalculation and monetary loss.

The calculator printed in black and red on white plastic fits into the passport, where it is kept readily available for prompt reference. European currency values shown on the form are compared straight across the board, so that one needing to interchange foreign money quickly during travel may see at a glance to what he is entitled. Figures represent average rates of exchange normally prevailing and include dollars-and-cents conversion equivalent. The "Instant Calculator" was designed and published by Wallace Miller of St. Albans 12, N. Y.

New Color-TV System

A new system to telecast live color programs without a TV camera has been developed by Allen B. Du Mont Laboratories, Inc., Clifton, N. J. The system should allow small TV stations to broadcast their own live color shows economically.

The reverse of conventional color-TV pickup, the new system uses a scanner that flashes a tiny, flying spot of light over the stage. The conventional camera is a light-receiving device.

As the spot of light skips rapidly back and forth over the stage, covering the scene line-by-line, "buckets" stationed around the studio register the reflection. The buckets contain 2 red, 1 blue and 1 green light-sensitive multiplier phototubes. These separate the light into its fundamental colors for TV transmission.

Thus, as the beam hits the green dress of a performer, the reflection is picked

an electrical signal. When the impulse is sent out and picked up by your color receiver, it will reproduce a green dot on the TV screen.

Dot-by-dot and line-by-line, the system builds up the picture. But it is done so fast that to the eye it seems a smooth-flowing picture.

A quick-flashing "sync-lite," similar to that used by photographers, alternates with the light spot from the scanner in quick succession. The room therefore seems light. But to the multiplier phototubes, made sensitive only between flashes, the room is dark.

A small crew can run the "Vitascan" setup, as it is called. Many stations already have the scanner, which contains a flying-spot cathode-ray tube, for use in televising black-and-white movies

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WHY THEY READ SCIENCE DIGEST

For a long while I have enjoyed Science Digest. Every issue is a "masterpiece"—varied, educational and easy to understand. My boys have been markedly benefited by reading your magazine. It is more fascinating than fiction.—Clarence E. Edson, industrial engineer, New Smyrna Beach, Florida

I have been subscribing to Science Digest for over two years and have enjoyed every issue so far. I just graduated from high school and will enter Carnegie Tech to study chemical engineering. My decision to go into the field of science has partially been prompted by your fine magazine.—Louis R Pandy, student, Beaver, Pa

I am very serious in saying that I learn a lot from the magazine and give it careful scrutiny every month, coming closer to 100 percent readership for it than for any other publication. The copy we get at home is read by the whole family. Other magazines are just looked at.—George S. Fichter, biologist and conservationist, Washington, D C.

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My

faked fingerprints

A fingerprint left at the scene of the crime does not always lead police directly to the criminal.

The guilty man may deceive police by leaving a false , made by his big toe. Unless pol are alert to this possibility, the criminal, even if apprehended, may "prove" his innocence by showing that his fingerprints do not match those left at the scene

Police are warned of this new possibility for deception by Dr. Louis J. van der Meulen, command er of the Leyden District of Netherlands National Police

A big toeprint looks pretty like a thumb print, Dr. van Meulen explains. The big toe usually larger than the thumb, the criminal can use a simple paper mask made by tearing a hole in a piece of paper. This brings the print down to thumb size tilting the mask to the right or left, the print can be made to like a right or left thumb.

The toeprint method of deception was not the invention master-mind criminal. It was thought up by Dr. van der

In 1943, Dr. van der Meulen and a companion were trip from occupied Holland to England. They tion papers. Forging the papers was a simple fingerprints presented a problem. When they available toes, the solution was easy and ments were ready in no time. Postwar tests prints could fool trained police.—Science

SCIENCE DIGEST

25¢

19th year of publication

what this changing world means to you

your life
30 YEARS FROM NOW

page 23

Y AGERS

Contrary to popular opinion, adolescence is not a period characterized by anxiety and tension, but is a period of confidence and high optimism.

This was found by Dr. Warren R. Baller, University of Nebraska educational psychologist. Dr. Baller was consultant to a nationwide HI-Y study which interviewed several thousand adolescents between the ages of 13 and 19. These interviews revealed little evidence of storm and stress in modern teen-agers.

"Instead," Dr. Baller said, "early results show adolescence to be a period of confidence and high optimism. You might say today's young people are keyed-up, but not afraid."

The Nebraska scientist says youth today is preoccupied with much the same problems young people have always faced.

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Why FALL Is Warmer than SPRING

by Dr. George H. T. Kimble

Condensed from a chapter of the book, Our American Weather

TAKE the monthly temperature averages of almost any weather station in North America, and you will find that the three autumn months of September, October, and November are warmer than the spring months of March, April, and May At St. Louis, for instance, October is 2 degrees warmer than April; November is 1 degree warmer than March; and September is 4 degrees warmer than May. Observation stations as far apart as Denver, Duluth, Calgary, Montreal, Pittsburgh, and Pikes Peak tell the same story.

Round the coasts the contrast is even more marked. Thus, at San Diego the average autumn temperature is 63 degrees Fahrenheit against 58.4° F. for the spring months. At Halifax, September and October are fully 9 degrees warmer than April and May.

The explanation of this difference is bound up with the annual variation of sea temperatures. The sea warms up and cools off much more slowly than the land. Whereas the land experiences its greatest heat in July (or August at the latest), the sea does not reach its peak of warmth until late August or early September.

Similarly with the minimum temperatures: over land these occur usually in January (or February at the latest), over the sea, not much before the middle or end of February. It is obvious, therefore, that the sea is warmer in autumn than in spring; the difference between
spring sea temperatures
proximately 5 degrees

Our American Weather, copyright 1955 by George H. T. Kimble and published at $4.75 by McGraw Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y.

fornia coast and 10 degrees off the Nova Scotia coast, that is, practically the same as the difference between the spring and autumn air temperatures.

However, this is not the complete story. The dominant air masses, polar and tropical, also play a part. In the spring the tropical air masses are seldom able to penetrate very far into the heart of the continent before finding their progress stopped by cold waves — those atmospheric "icebergs" that are continually "calving" from the glacierlike anticyclone (high-pressure areas) that then holds the western Arctic in thrall.

These cold waves are still very cold at that season, and over the continent as a whole are more likely to send the mercury shooting down to winter levels than the warm waves are likely to send it soaring up to summer levels. In the fall, the northern half of the continent is enjoying the afterglow of its short summer day: its rivers and lakes are still for the most part unfrozen, and although there may be snow on much of the ground, by November at least, cold waves are uncommon. Furthermore, when they do occur they are nothing like as cold as those coming at the winter's end when the land is still numb from its exposure to the long arctic night.

engaged on Invasion weather projects in

Since as yet no formidable anticyclone has arisen to fend off all would-be intruders, tropical air masses stand more chance of penetrating into middle latitudes than in spring. And because they originate over the still warm seas of the Caribbean and Gulf of Mexico, their arrival is more likely to produce a spell of belated summery weather than the arrival of a cold wave is likely to produce a spell of premature wintry weather.

The weather year is full of oddities, unexpected changes, sharp reverses, misplaced days quite out of tune with the month, and even, so we are sometimes tempted to think, misplaced seasons.

Indian summer is such an oddity, a most agreeable one to be sure, for it comes, usually in the latter half of October or the first half of November, after we have already felt the first chill winds of autumn and awakened to see the hoarfrost lying thick on the ground. It comes, as a *New York Times* editorial writer once put it, "as a final reprieve, as a sad last look at the world in congenial colors before the ground becomes hard again, the gutters gray with sleet, the skies barren and flat like dirty metal." It may not even be the final reprieve, either, for many an October conjures up two distinct spells of balmy weather separated by a colder spell, and it is not unknown for a fall to produce three or even four.

While there is no knowing precisely when such spells will occur, the chances are that, in any given locality, they will be more partial to certain dates than to others. In the region of Montreal and the lower St. Lawrence, for instance, Indian summer is more likely to come during the five-day period from October 5 to 9 than at any other time of the month, and least likely to come between October 15 and 19 and between October 23 and 27.

In our uncertain North American climate, temperature relapses to the previous season are of course not confined to any particular time of the year All the same, they seem to show a marked preference for autumn and spring that is, for the periods when the semi-permanent highs which play such a large part in our weather economy are jockeying for their favorite winter and summer positions. And of the two transition seasons, autumn is the more likely to experience a prolonged "relapse."

In autumn the atmosphere is less subject to violent territorial exchanges of air than in spring, when, as we have seen, there is often a strong southward flow of cold air from the snow-covered barrens of northern Canada: the weather is, on this account, more stable and less given to spasm. Further, when a part of a high-pressure area toward our southeast stagnates over the continent in autumn, it is less likely to give dull weather than in midsummer when the power of the sun makes for more rapid cloud formation.

Many theories, none of them very convincing, have been advanced to account for the name "Indian summer." Most of the pundits seem to lean toward the view advanced by a writer in the *Boston Transcript* more than a hundred years ago (June 8, 1832), namely, that, "The Indian summer is so called because, at the particular period of the year in which it obtains, the Indians break up their village communities, and go to the interior to prepare for their winter hunting." Another possibility is that the early settlers in the interior attributed the blue haze which commonly characterizes Indian summer to the smoke of the prairie fires set by the Indians at that season.

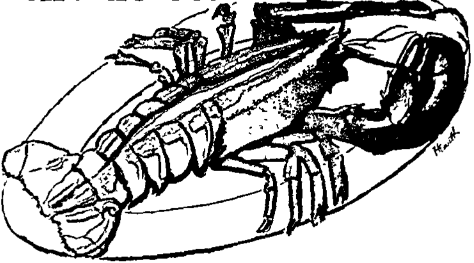
A third explanation, less likely but by no means impossible in view of the trans-Atlantic origin of so many of our weather sayings, is that the name was given by some early European explorer who saw in these spells of dry, hazy weather a similarity to atmospheric conditions in India during the same months.

Or maybe we need to look no further than another phrase in common parlance, namely, "Indian giver," the giver who is fickle and something of a sham; for such is Indian summer, the time when one feels, in William Morris's words,

. . . the treachery of the sun
And knows the pleasant time is
well-nigh done.

But what matter if the origin [illegible] the name remains as hazy as [illegible] weather it designates? [illegible] mer is to be enjoyed, rather [illegible] plained; accepted as a [illegible] questioned as a [illegible]

the delectable lobster



by A. Hyatt Verrill

Condensed from a chapter of the book, Strange Creatures of the Sea

EVERYONE KNOWS the lobster, but few of those who relish the big crustacean's delectable flesh—boiled, broiled, in lobster Newburg or served as a salad—know very much about lobsters' lives or habits, or that a lobster is not always a lobster.

If you should drop into a restaurant in Florida, the West Indies, Bermuda, South America or on our Pacific coast, and order lobster, it would be served minus claws; you might ask the reason why. The answer is that the so-called Florida, West Indian, or South American lobsters do not have claws. Actually they are not true lobsters but sea crayfish; if you insisted on being served real lobster in Florida you would be given Maine lobster—at a very high price.

On the other hand, if you were dining in England or on the Continent you would find both lobster and crayfish on the menus, for both true lobsters with claws and the clawless "spiny lobster," or sea crayfish, inhabit the waters of Europe and the British Isles, although in this country the true lobster will not survive in the warmer waters of the south.

Whether or not the true lobster of the north or the "Florida" lobster of the south is the better—from a gastronomical standpoint—is debatable. A great deal depends upon the size of the creatures and the manner in which they are cooked. Northern lobsters over 2 or 3 pounds in weight are rarely served, whereas the sea

crayfish or "Florida lobsters" may weigh 10 or 12 pounds; even 20- or 25-pound individuals are common. Today, northern lobsters weighing 10 pounds or more are very scarce and when a 20-pounder is taken, it is front-page news.

Size for size, given the same method of cooking, there is not much difference between the flesh of the northern lobster and the sea crayfish in the matter of tenderness, but there is no question that the meat of the northern lobster is usually sweeter and better-flavored than that of the sea crayfish.

At the present time, the Florida lobsters are for sale in nearly all of our northern fish markets and are listed on the menus of many restaurants in New York and other large cities; the exportation of sea crayfish and crayfish tails from Florida and the Bahamas to the northern markets has become an enormous business and there is scarcely a portion of the country where crayfish are not obtainable.

The abundance of these sea crayfish is almost incredible. All through the season during which lobstering is legal in the Bahamas, scores of big ocean-going lobster boats ply steadily back and forth between the Bahamas and the Florida ports, making the round trip every week or ten days.

On every trip their capacious holds are filled with thousands of crayfish packed in ice. As soon as they reach the fish docks, a certain proportion are repacked in barrels of ice to be shipped alive. Others are placed in huge vats and boiled; thousands of the tails are quick-frozen and shipped in cartons.

It would seem as if the millions of these crustaceans caught in the Bahamas would soon deplete the supply, even though they are protected by a closed season, but apparently there has been no decrease in their numbers so far.

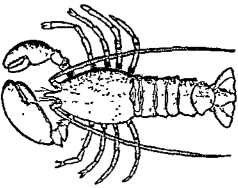
If you should watch these Florida lobsters being unloaded from the boats you would doubtless be surprised to see that they are red, for unlike our northern kind, which are greenish in life and only turn red when cooked, the sea crayfish are naturally reddish or orange and are handsomely decorated with eyelike spots. Hence their scientific name of *Palinurus argus*, or eyed spiny lobster.

Even without nipping claws, these spiny lobsters may not be handled carelessly. The stout bases of their extremely long antennae are covered with thick, needle-sharp spines. Long, curved spines project from the front of the head; rows of spines stretch along the back of the shell; and each segment of the tail is armed with razor-edged spines on both sides and in the center.

• • •

Now, having straightened out the matter of when a lobster is not a lob-

• I do not know what I may appear to the world, but to myself I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.—Newton



MAINE, or common, lobster, showing the typical enlargement of one claw.

ster, let us return to the real lobsters of our northern seas, for we will find that, quite apart from their interest as food, they are strange creatures indeed.

It is odd that lobsters should be considered edible at all when we consider their habits. Few people will eat crows and no one would dream of dining on a vulture, yet neither of these birds can compare with the lobster when it comes to the matter of feeding on carrion. Lobsters may at times prey upon other living creatures, but they are primarily scavengers and prefer carrion to fresh meat. However, our ideas of what is fit for food and what is not are largely a matter of habit or custom. Both swine and poultry devour carrion—and almost anything else—yet they are almost universally regarded as excellent food, which is as it should be, for the food upon which any creature subsists seldom affects the edibility of its flesh.

Although lobsters live in inaccessible locations and only a small percentage are taken in traps, they would have been practically exterminated long ago had it not been for the enactment of stringent laws limiting the legal size of lobsters to be marketed and the establishment of lobster hatcheries at various places along our coast. Lobsters are very prolific creatures Every female will produce many thousand eggs each season; if 1 out of every 500 baby lobsters survived and grew up, there would always be a good supply of lobsters for human consumption.

Young lobsters, however, lead a dangerous and precarious life from the time they hatch from the eggs until they acquire a hard protective shell and powerful claws. Every carnivorous sea creature is as fond of young lobsters as human beings are fond of the adults; fish, mollusks, crustaceans — practically all the meat-eating marine animals — destroy a very large portion of the immature lobsters. Undoubtedly nature would have maintained the balance of maritime life, as far as lobsters were concerned, had not man come into the picture and completely upset the balance by the wholesale taking of lobsters.

At one time the lobster fishermen destroyed the lobsters faster than they could breed and increase, for female as well as male lobsters were captured. The taking of females during the breeding season meant the destruction of thousands of potential lobsters. Once the lobster population began to decline, the doom of the lobster became a possi-

bility. To make the matter worse, the demand for lobsters increased as the supply decreased. Within a comparatively short time our native lobsters would have become as extinct as the dodo, had not our Bureau of Fisheries taken a hand in the lobster problem.

Female lobsters with eggs were protected in hatcheries and young lobsters were cared for there until they were large enough to look after themselves. Every year millions of the youngsters were given their freedom, but for some inexplicable reason there appeared to be no noticeable increase in the supply of grown lobsters.

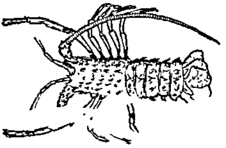
Finally, by mere chance — as so often is the case with notable discoveries — someone discovered that young lobsters, hatched from the eggs in the tanks and artificially reared, did not dive to the bottom and hide among the rocks as did the wild youngsters. In their artificial environment they had lost the instinct to safeguard themselves; when released they merely swam about near the surface, thus falling easy victims to all their natural enemies. If the lobster population was to be maintained or increased, some means had to be found to induce the young lobsters to seek hiding places safe from their foes.

The problem was finally solved by teaching the infant lobsters to dive by sliding them down a chute which led to the bottom of the tanks, and repeating the process over and over. After a time the little creatures — who apparently possessed some intelligence or liked the fun—learned to dive of their own accord and as soon as released promptly dove to the bottom of the sea. Today every lobster hatchery has its professional lobster-diving teachers. The lobster population is increasing; there is little danger of the delectable crustaceans being fished out.

Although the "soft-shell" or "shedder" crabs are well known to all who enjoy sea food, comparatively few people know about soft-shell lobsters. Like all the crustaceans that are forced to throw off their armorlike shells when they are outgrown, lobsters change their outer garments whenever they become too tight.

Very few people have ever watched a lobster in the act of shedding, for from that time until the new shell becomes hard they are helpless, and take care to safeguard themselves by retiring to some deep crevice in the rocks or to a den under a stone. But it is possible to observe a lobster as a creature in an aquarium where there is no chance for it to hide

When the time comes for the



FLORIDA and West '
sea crayfish; also call

change, the lobster's shell splits open along the back; the two sides fold open; the head and forward part of the body, soft and flexible, come slowly forth; the antennae and legs, as well as the claws, are withdrawn from their hard coverings; the tail is freed and the soft, pulpy, naked-looking creature—motionless—waits for its skin to turn to shell. This does not take very long, and normally the transformed creature remains in hiding until the new shell is completely hardened.

Everyone who has seen these fellows must have noticed that one claw is almost always larger and heavier than the other. The answer to the puzzle is that the lobster's claws serve a dual purpose; each one is designed for a specific duty. With the smaller, more slender and pointed claw the lobster captures fish and other prey, drives off or attacks its enemies, and tears up its food. The larger, blunt-ended claw, with its broad, dull teeth, serves to chew shells and other hard creatures, to act as a shield when the lobster is attacked, and to crush captured enemies to death.

Like all of the crustaceans, the lobster may lose one of its legs, an antennae, one or both claws, or various other portions of its anatomy, and

[illegible]

tributes.

will appear with all the missing par replaced with its next change of ski Often, however, some minor inju to a leg or claw may result in the fo mation of a freak appendage; it not unusual to come across a lobst with one claw doubled or with t legs where there should be one.

Although the lobster is rat sedentary in its habits, and does wander very far from its chosen la it is an excellent swimmer. By r idly extending its tail and spasmo cally flapping it forward, the lobs propels itself backward, its le claws, and antennae trailing in wake.

Since northern lobsters rely much upon their claws for fighti and for capturing and cutting their food, you may wonder how clawless sea crayfish survive.

Unlike northern lobsters, who vour dead fish, live fish, shells, ot crustaceans and almost anyth else, the crayfish devour only sn creatures that do not have to be t to bits in order to be swallowed, well as carrion that is so thoroug decomposed that it almost falls pieces.

The legs with the brush-cove tips serve very well for seizing the small fry as the crayfish lie in wait in their dens, their long whiplike antennae extended to catch the least vibration of the water caused by some moving object.

Quite frequently, if you watch these spiny lobsters carefully, you will see them rub the bases of the antennae across the forehead, producing a faint, rasping sound some-

what like that made on a violin string by rubbing a matchstick across it. As far as I know these creatures are the only crustaceans capable of producing an audible sound. Obviously the crayfish can communicate by means of these notes, for if there are other crayfish near at hand they will wave their antennae, rise high on their feet, swing their heads toward the sounds and show every indication of listening. Moreover, careful tests have proved that the spiny lobsters can and do produce a variety of sounds which are supposedly "picked up" or heard by the sensitory hairs on their legs. As one scientist put it, they talk through their noses and hear with their feet.

The crayfish, like our northern lobster, is an expert swimmer; when swimming or walking on the sea bottom it moves far more rapidly than the true lobsters. Its speed is partly due to its much longer legs and more powerful tail and partly because it is not hampered by heavy, cumbersome claws. Like the ordinary lobster and other crustaceans, the sea crayfish shed their shelly skins and produce new legs or other appendages to replace those that have been lost or injured. They are far more hardy than any other crustacean I have ever seen; and they will survive the loss of a large portion of their bodies, even though it cannot be replaced.

Element 101 Discovered

The discovery of element 101, a synthetic unit of matter which does not exist in nature and has never before been observed on earth, has been reported by the University of California.

Element 101, named mendelevium (chemical symbol Mv), after the great 19th-century Russian chemist who developed the periodic system, is the heaviest atom known, standing nine *steps up the periodic table from uranium*, the most massive atom commonly occurring in nature

It was created by bombarding element 99, another synthetic form of matter, with 41 million ele[illegible]-volt alpha particles, the nuclei of helium atoms, fired from the university's 60-inch Crocker cyclotron.

The new element is intensely radioactive. Its half life (the period in which half of a given quantity will decay, or transform itself, into another element) is between a half hour and several hours

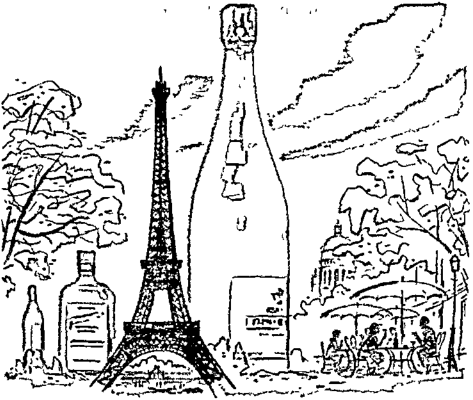
The scientists made element 101 from *about a billion element 99* atoms—a quantity of matter too small

They identified only 17 -

eight experiments — an

weighable and almost

small amount of matt



WORLD'S HEAVIEST-DRINKING NATION!

by Blake Ehrlich

Condensed from This Week Magazine

SEVERAL hundred thousand Americans home from touring France this summer are telling their friends about the sights they saw. Undoubtedly many of them also make a familiar tourist's comment on a sight they didn't see: "One thing about France — you never see a drunken Frenchman."

It's pretty true, too The rarity of public drunkenness is quite a striking phenomenon in France. In fact, the tourist pretty surely wouldn't guess that Frenchmen drink, man for man, far more than any other nationality.

When Premier Pierre Mendès-France in late 1954 introduced his program to curb alcoholism, he called liquor "the main scourge of France." It was Mendès with his glass of milk who finally focused world attention on his nation's excessive drinking, and his efforts to stop it contributed to his political downfall.

The pure-alcohol content of all

This Week Magazine (June 5, '55), 421 Lexington Ave., New York 17, N. Y.

drinks downed by the average Frenchman in a year amounts to 30 quarts. The supposedly hard-drink-

The fact is, the French drinker rarely gets falling-down drunk; he simply goes through life never quite sober. By Drunkometer test, the level of alcohol in his bloodstream may exceed the margin of intoxication, but to the casual observer, he is sober.

Even during the national three-day toot for the observation of Bastille Day, with dancing in the streets and constant tippling, a drunk as we know him is hard to find—but an astonishingly large part of the population is contentedly plastered

There has been enough publicity given to our own national drinking problem for us to realize how much more acute it must be in France. And the official figures don't tell the whole story. Every farmer in the grape country makes his own wine, and in the northern regions where the vines give way to orchards, there are literally millions of tax-free legal home stills turning out uncounted kegs of applejack, pear nectar, peach, plum and cherry brandy.

If you don't make the stuff yourself, you don't have to go far to buy it, since there's 1 grog shop for every 144 persons in France, as compared to 1 for every 1,000 in America. Ten percent of the average French family's budget goes to buy alcoholic beverages.

The government budget also suffers the same bottle-born distortion: 54 billion francs credit from liquor taxes; 152 billions debit for court costs, hospitalization, care of abandoned children, industrial accident compensation, family care, etc.

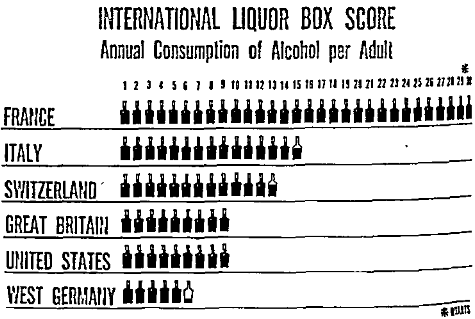
Over and above this figure, there are other state expenses stemming from intemperance, such as police expenses in handling auto wrecks (drunken driving accounts for one-quarter of the total). Also for handling juvenile delinquents of sodden parents, and for care of prisoners whose crimes arise from alcoholism.

During the Public Health budget debate, these figures were submitted, together with the comment, "It is impossible to estimate how many billions of francs a year are lost to the French economy through lack of productivity owing to abuse of alcohol"

Drinking during the work day is a matter of course, and the boss never frowns on it. The worker's lunch pail in France has its bottle of wine exactly as in America it has its milk or coffee container. Continuous imbibing doesn't prevent a man from doing his job, but it obviously prevents him from doing the job he should.

Until a few months ago, the majority of Frenchmen, in spite of government reports and parliamentary debates, refused to believe there was any problem, even though they themselves suffered from the ill effects of overindulgence. They found other explanations for their "liver ailments."

Most Frenchmen, except for hard-cider and applejack dri Normandy and Brittany



bibbers, and, as they will tell you, "A little wine never hurt anybody."

According to Dr. Etienne May, reporting to the National Assembly, 65 percent of French alcoholism is due to the abuse of wine. But the pro-wine propaganda is not easy to contradict. For example, a Frenchman is told, believes, and repeats, that a bottle of wine contains as much nourishment as "5 eggs, or ½ of a bottle of milk, or 370 grams of bread, or 585 grams of meat."

French faith in the virtues of wine, "a healthful, natural drink, the product of grapes and sunshine," has remained unshaken even in the face of statistics: alcoholism kills more Frenchmen than tuberculosis; alcoholics admitted to psychiatric hospitals increased 200 percent between 1940 and 1951; and finally, most shocking, alcoholism has been found even among children. Many French parents refuse to believe wine can be harmful.

"You hear, *ma petite fille*," mothers have said to their four- and five-year-old daughters in the doctor's office, "it is the doctor who is taking away your wine, it's not Mamma."

Doctor Suzanne Serin, who repeated this maternal statement to me, says, "Habitual alcoholism in French children is a day-to-day fact. Depriving children of wine seems to many parents the same as depriving them of dessert."

Doctor Serin reported some of her findings to the Academy of Medicine, among them these three cases:

Child, 19 months old, dead in hos-

pital of delirium tremens after a deworming treatment with *pastis* (a mild form of absinthe with a high alcohol content).

Lucien, 5 years, refused by numerous nursery schools because so emotionally unstable. Drank half litre (somewhat over a pint) wine daily because, according to father, "water carries polio." Alcoholic.

Pierre, 7 years, intelligent, charming child, suddenly turned morose and aggressively bad tempered. Admitted to psychiatrist, "At night I see wings—no, hands—white things which dance on the dresser of my room. It's terrifying." Child drank "only pure wine," about a bottle a day, and at night, "because we find him nervous," a glass of port with two beaten eggs.

The gravity of the situation can be gathered from one of Dr. Serin's recommendations to the Academy that "it should be forbidden for children to bring wine to school to drink with their midday meal."

[illegible]

begun admitting that, yes, alcoholism is a problem in France.

They have also found a convenient villain, the *"bouilleurs de cru"*—the legal moonshiners, of whom there are more than 3,650,000.

They are entitled to make about 10 million gallons of hard liquor tax free, the idea being that as farmers they have the right to distill their surplus fruit for their own consumption. Village mayors may grant the privilege on simple application.

According to Dr. May, it is probable that farmers "sneak" another 10 million gallons. But those who cite Dr. May to put the blame on moonshiners conveniently overlook his statement that most of France's alcoholics are wine drinkers.

At the end of 1954, the Mendès-France government issued a series of 11 sobering-up decrees, and sent 8 bills to the Assembly seeking to prevent the growth of the number of moonshiners and control the number and use of stills.

By the time this appears, some of these bills probably will be in force. The proposals include closing drinking places one day a week, stiffer fines for public drunkenness, increased liquor taxes, and cutting down the number of establishments. Every applicant for a liquor-selling license will have to present the licenses of two other establishments he's bought out; thus for every new cafe opened, two old ones will close.

It was at least in large part because of his anti-alcoholism stand that Mendès-France was forced from power. In this he was no different from several of his predecessors who also found it impossible to buck the powerful liquor lobby.

Mendès-France went a good deal further in reducing alcoholism than his anti-alcohol laws and decrees indicate. He did more than simply deprive the workman of his early morning eye-opener, "café arrosé," coffee with a shot of rum in it. [illegible]
long-term processes [illegible]
change the [illegible]
by changing the [illegible]

The programs, aimed at the roots of alcoholism, will stimulate consumption of non-alcoholic drinks, banish the vine from many vast wine-growing tracts and give Frenchmen decent homes.

The Assistant Director of Penitentiaries, Jean Marcel Coly, who reports that about 41 percent of the men passing through the receiving prison at Frèsnes are alcoholics, says of first offenders, "To avoid repeaters, it would perhaps suffice to eliminate one or two of the elements which helped their first fall: bad housing and alcoholism."

Many authorities maintain that bad housing is a big factor in alcoholism. Rather than go home to his overcrowded, primitive, unhealthful flat, the workman hangs around the *bistro*.

The housing distribution for France gives 1 room to every 1½ Frenchmen. Two million families live in houses built before the Napoleonic era—175,000 of these families in dwellings which date from the time of Christopher Columbus. In Paris, 180,000 persons inhabit condemned buildings which entirely lack running water, electricity, gas, toilets.

A shake-up of the housing ministry, a bigger housing appropriation, clarification of the bumbling credit regulations, and a serious start on slum clearance and low-cost building marked the last quarter of 1954.

The other prong of the offensive has even more far-reaching significance. The bulldozers started to roll last spring to reconvert 15 percent of the wine-growing area of France to diversified crops. An irrigation project covering the lower Rhone Valley and Languedoc in Southern France will end the uneconomic one-crop system which has been spilling mediocre wine onto the market for centuries.

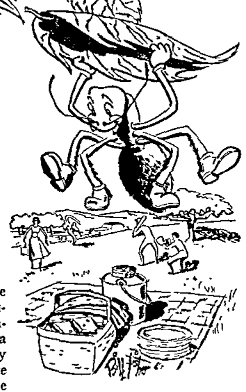
Soldiers, whose wine ration was doubled between the wars at the behest of the lobby, are now getting a daily ration of milk. It must be admitted that milk generally in France is a thin, poor-tasting, expensive, fluid. When Dr. Serin ordered her infant alcoholics off wine, she put them on water, never even mentioning milk.

Milk is disliked and distrusted. Now children are getting free milk at school lunches, and the government is aiding the dairy industry to improve its output and the quality and flavor of milk. The fruit-juice industry is also getting the same sort of government encouragement.

Changing the habits and thinking of a whole population is difficult, but it is not impossible. The eight-month trial of the Mendès-France regime showed that long-ignored problems could be brought to public attention, and public support could be rallied for real national effort.

Refrigeration temperatures for maintaining egg quality for short periods range from 35 to 45 degrees Fahrenheit, with humidity at about 85 percent.

AMAZING HABITS OF *ANTS*



by O A. Battista, Sc.D.

ANTS have outsmarted me on more than one occasion. In particular, there was a weekend last summer when an ant scientist was a guest at our cottage. I boasted to my naturalist friend that I could store food in an open container for a whole week and keep it safely out of the reach of house ants.

Sunday night the experiment got under way. I put a large wooden tub on the kitchen floor of our cottage. After filling it to about the three-quarter's mark with water, I placed a high wooden stool in the middle of it. On top of the stool, I put a saucer containing the bait: three or four pieces of rich chocolate candy.

Then I painted a wide band of very slow-drying glue around the outside of the wooden tub. With that, I stood back and admired my ant trap, fully confident that the bait would be untouched upon my return to the cottage the following weekend.

When my naturalist friend and I entered the cottage just six days later, ants were swarming over the bait!

Here's how they put me to
Single files of ants had

A HARVESTER ANT'S leg being nibbled by a "knee-high" ant-loving cricket. Harvester ants allow these "guests" to live with them in their burrows.

head-on into the band of glue around the outside of the wooden tub A handful of them had endured martyrdom, for they had embedded themselves end to end, and made causeways of their bodies

The tempting bait on top of the stool must have taxed their little domes to the limit. Ants hate water, but they had been courageous enough to build a highway across the stretch of water to a leg of the stool. They had assembled tiny shreds of grass and slivers of wood no longer than a 32nd of of an inch, and had glued them together with saliva until their bridge extended from shore to island Once they reached the leg of the wooden stool, traffic was almost all one way toward the chocolate bait.

But there were some show-off fellows around, too; they were doing things which ants have been known to do very rarely. We noticed that a half dozen or so were walking across the ceiling, and when they came directly over the bait they let themselves fall squarely into the middle of their merry brethren

It is little wonder that I have been on the trail of ants ever since, trying to trip them up or at least learn some of the special tactics that they use.

On fine sunny days, I have followed ants hour after hour. It is not strange that they get so much mischief done, for when they work it's all work and no play.

Few insects are fonder of the sun than ants. They will go to great pains to bring as much sunlight as possible to their little worlds. I have watched them systematically clear their "backyards" of shrubbery, plants and leaves. The stems of annoying plants or weeds are literally chewed off very close to the ground And any low-lying vegetation that threatens to block the sun's rays from their paths may be liquidated by charges of formic acid aimed at the base of the plants.

The ability of an ant to travel relatively great distances from its home and return to it at will has puzzled more than one scientist.

For example, Prof. Charles D Michener of the University of California captured ants wandering far from their domicile. He tagged them by means of various stains, and followed them in their meanderings

When he put blinders over their eyes, he discovered that the ants wandered about hopelessly. But as soon as the blinders were removed, they got their bearings in short order and were able to head straight for their headquarters.

The Michener experiments have done much to support the prevalent belief that an ant finds its way by means of a remarkable memory. It seems capable of remembering tiny twigs, flowers, pebbles, or cracks in

the terrain which serve as guideposts.

Professor A. La Fleur has noted the slick tricks with which ants take a lot of our fun out of picnics. Among other things, he has watched the little fellows climb to a leaf on a low-lying limb of a tree, a leaf which happened to be centered over a lunch basket. Once in the proper positions, the ants proceeded to chew off the stem of the leaf and glide down into the middle of the sandwiches.

Ants are prodigious athletes in proportion to their size. They can lift a weight 400 times their own weight. Theoretically a 5-pound ant could easily lift a ton.

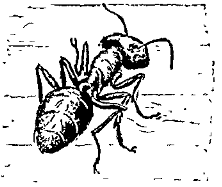
Ants tend gardens. Ants have pets Ants harvest grain Ants store up food. Ants keep "cows" which they milk, put out to pasture and sometimes even protect with sheds.

The most skillful farmers in the insect world are the small, heavily armored parasol ants.

They work at night, foraging for succulent vegetation. It is nothing for them to strip a large tree at a time, marching off with bits of leaf held over them like parasols.

Surprisingly enough, these ants do not eat the vegetation they plunder. Rather, they use it as raw material for their remarkable underground gardens. The shreds of the leaves are literally chewed into a rich compost which is used to strengthen the gardens where a thread-like fungus is cultivated. This species of fungus is their only source of food.

Included in the extraordinary parasol ant society are tiny garden workers, slightly bigger workers who ex-



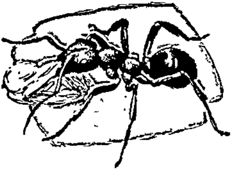
THE CARPENTER ANT, a thick-jawed woodcarver, bores elaborate galleries in trees and in the rafters of houses and the trestles of wooden bridges.

cavate the interconnecting chambers of the hive, medium-sized, scissor-jawed ants who do the foraging, and extra large and well-armed soldiers. The prolific parasol queen ant, more than 100 times the size of the garden workers, is waited upon hand and foot by myriads of lesser ants.

• • •

The British entomologist, R. W. G. Hingston, once made an interesting experiment He cut a dead grasshopper into three pieces, the second piece twice the bulk of the first, the third twice the bulk of the second. These bits he placed where ant scouts would be certain to find them. As each ant discovered its prize, it hurried back to the nest to summon help.

Forty minutes later, the scientist counted the number of ants gathered about each piece of grasshopper. There were 28 of the insects smallest fragment, 44 at the mediate one, and 89 at the piece. These numbers roughly one another, and are



A RED SLAVE-MAKER ANT kidnapping the helpless pupa of *Formica fusca* (common black ant). The victim will be reared to maturity in the Slave-Makers' colony, and will thereafter serve its red masters as a slave.

in the same proportion as the bulk of the pieces of food. The different scouts had summoned parties proportional to the needs of the task.

Ants, like their four-legged and two-legged kindred, may "get the jitters" if they run into a situation that is too much for them The story of such a neurotic ant is told by Dr. Derek W. Morley of the Institute of Animal Genetics in Edinburgh

Doctor Morley maintains a colony of ants in his laboratory To test their intelligence he puts them through a maze, similar to the larger apparatus used with laboratory rats.

One time he put one of the most intelligent of his ants back into the maze within five minutes [illegible]

presently was in a dead-end alley.

Instead of immediately retracing its steps and trying to find the right path, the ant remained at the end, feeling around the three walls and showing continually rising excitement. Especially noticeable symptoms were jerkiness in movements of legs and antennae.

Finally the ant faced the other way, but seemed to have lost control of itself. With legs still jerking, it staggered backwards in a circle.

Doctor Morley rescued the ant, ran cold water over it for a few seconds, and then put it back into the nest, where the ant soon recovered and ran around normally.

The next time an ant takes a short-cut across your picnic cloth, it may put matters into perspective to reflect that ants were here before we were. Long before.

On the evidence of ant fossils preserved in amber, it is known that at least 30 million years ago ants were living together just as they are today, in large communities, having a caste system, with division of labor.

• • •

"When we consider the habits of the ants," wrote Lord Avebury, pioneer English student of these insects, "their social organization, their large communities, their elaborate habitations, their roadways, their possession of domestic animals and even, in some cases, of slaves, it must be admitted that these remarkable insects have a fair claim of instinctive intelligence."

Around the world, this instinctive wisdom is in evidence. Ants are to be found everywhere: in jungles and deserts, in the heart of Manhattan and London and Paris, on the slopes of the Rockies and Himalayas and Andes Thirty-five hundred species are known to science.

MAN-MADE MOON

WITH ALL HIS INGENUITY man has achieved relatively trivial extensions of his frontier—16 miles into the air with a rocket plane, 2½ miles down into the sea with a bathyscaphe.

Now there has opened up before man an almost limitless vista for journeying

quer gravitational force by placing in the heavens a man-made satellite of the earth

The effort to conquer space involves, among many others, two problems that are fundamental. One is the atmosphere. The air is dense at sea level and

But at lower levels the density of the air is a heavy drag on speed; in the upper levels the air is too thin for winged flight and its oxygen too scant.

The answer is the rocket, which carries its own oxygen, needs no wings, and is capable of enormous velocity. Having punched its way out of the atmosphere, a rocket could fly indefinitely, in accordance with a principle of Newton-

other. The closer they are together, the greater this gravitational force. But this force can be overcome, or balanced in a state of equilibrium, by speed, or velocity. Scientists calculate that in the immediate region of the earth a velocity

But the more immediate aim is to achieve the equilibrium of a satellite.

A rocket of two or more stages will be built. Its payload will be an object of 100 pounds and be the size of a basketball. The whole contraption will be launched vertically, in order to get out of the dense atmosphere in the quickest way possible.

"The bird" will now be flying free. Its velocity will be 18,000 miles an hour, fast enough to circle the earth in 1½ hours; its altitude 200 to 300 miles. It will be too low and too slow to escape into space. Moreover, there probably will be air particles at its altitude that will gradually check its speed. "The bird" will descend in a shallow spiral. After some days—or "if we're lucky, weeks," as one scientist put it—it will crash into the heavier atmosphere and quickly burn to vapor.

around dawn and dusk.

Just what "the bird" will consist of

Beyond the flight of "the possibilities about which only theorize—a satellite a permanent satellite a spaceship. — *The*

WHAT HAPPENS TO OLD MONEY

by Ralph Reppert

Condensed from
The Baltimore Sunday Sun Magazine

IF IT WILL make you feel any better, a dollar doesn't last the United States Treasury long either. Nine to 11 months after it is issued as a clean, crisp bill, it has become torn and dirty and so limp it is difficult to handle.

Ordinary usage does it. One man folds his money vertically. Another folds it lengthwise. The next may crumple it into a wad and jam it in his pocket. Filling-station attendants smudge it with gasoline and oil. Bartenders get whisky on it. Many dampen it with perspiration.

When the dollar becomes a dismal gray and too limp to keep its shape when held extended by one edge, it is deemed unfit to circulate. Then it is retired, and a new one is issued in its place.

Every year this happens to about a billion of the 1,255,000,000 *one*-dollar bills generally kept in circulation. The 35,500,000 *two*-dollar bills and the 419,600,000 *five*-dollar bills now in circulation will last, on an average, half again as long as the *ones*.

The higher the denomination, the longer a bill lasts. Among the $28,675,000,000-worth of paper money now circulating, only the bills of the five lowest denominations present an appreciable replacement problem. Comparatively few replacements are needed for bills above $20 denomination, and extremely few for those above $100.

None of the country's highest denomination bills, the $100,000 notes used by Federal Reserve banks occasionally for the transfer of credits, has ever been worn out.

Anybody can start an unfit bill toward retirement simply by taking it to a bank and exchanging it for a clean one. The way the bank retires it, then, is a bit more complicated.

Unfit United States notes ($2 and $5 bills, "greenbacks"), and silver certificates ($1, $5 and $10 bills) are sent by private banks to one of the

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The Baltimore Sun (May 8, '55), Baltimore 3, Md. Copyright 1955.

country's 36 Federal Reserve banks and branches.

The Reserve Bank sorts out the money, by type and by denomination, and cancels it by perforating it with holes of a distinctive shape, in a distinctive pattern The money is then stored temporarily by the "tape." A tape is 100 bills secured by a strip of gummed paper.

The branch bank next cuts the tapes in half, lengthwise, and makes them into packages of upper halves and lower halves. It then sends a shipment of lower halves to one of the 12 Federal Reserve parent banks. After the parent bank acknowledges receipt of the lower halves, the branch bank sends the upper halves.

After detailed checking and rechecking, the worn-out money is dumped into a furnace, before official witnesses, and burned.

The Federal Reserve banks destroy only United States notes and silver certificates. The Federal Reserve notes (bills of $5, $10, $20, $50, $100, $1,000 and $10,000 denomination) they sort by denomination and by bank of issue. They forward these to Washington—first the lower halves and then, upon receipt of a coded telegram, the upper halves. The United States Treasurer's Office supervises the final destruction. (About ⅞ths of circulating currency consists of federal notes, which are issued by the Federal Reserve banks, are guaranteed by the government, and must have a gold backing of at least 25 percent.)

The government once destroyed worn-out paper money by maceration. It used 9 two-ton revolving drums, the interiors of which were lined with spikes and blades. The paper money was dumped in. Soda ash, lime and hot water were added. After a few hours there was left only a thin, soupy mixture which various firms bought by the ton.

The pulp—half linen and half cotton fibers — made excellent cardboard. It was also used at one time to make papier-mâché souvenirs. But the government made little, if any, profit on the sale of it, and so in 1943 began destroying old money by fire, which was less expensive.

Each of three furnaces in the Bureau of Engraving and Printing Annex in Washington is about the length and width of an average living room, and 2½ stories high. Lined with fire brick, and encased in heavy steel, each has a firebox 10 by 10 feet and 18 feet high. One of the furnaces is used to burn ordinary waste. The others burn currency spoiled in printing, and other paper scraps gathered up in the Bureau, redeemed government bonds and interest coupons, and confidential papers.

Old money on the way to the furnaces is handled as carefully as new money on its way to the banks. With witnesses standing by, it is brought in locked steel hand trucks to the maws of the furnaces, two floors up from the ash pits, and dumped

Through a speaking tube cial on the second floor gives ing order to another off basement, whereupon papers are touched off w and tossed into the

furnace. Natural draft does the rest. Gas, oil or other inflammables are not needed.

Twenty-five million dollars worth of old bills burn to fine ashes in four to five hours. Officials examine them.

Department of Agriculture attachés, across the street, used to ask for the ashes from time to time. Rich in nitrogen, it was thought they might do well as fertilizer. But they were too rich.

So, good for no known purpose, the ashes are now loaded into steel drums and carted off to a dump.

There is about $62,000-worth of paper money outstanding which the government doesn't ever expect to replace. It consists of 5-, 10-, 25- and 50-cent bills, last printed in 1876, which collectors are keeping.

The replacement of coins (there is $1,832,000,000-worth circulating now) isn't much of a problem, for most coins can stand normal wear and tear for at least 30 years. The larger a coin, the longer it takes to wear off its design. Pennies and dimes last 30 years or more, nickels and quarters 35, half-dollars 40, and silver dollars last 50 years or more.

There are unnatural forms of wear and tear, and other conditions, however, which necessitate a constant, if comparatively small, replacement schedule. The government is receiving some of the zinc-coated steel pennies (1,093,000,000 of them) which it put into circulation during the war, for example. The better portion of them is still circulating.

The steel pennies which do come in are put through heavy stamping machines, which mutilate them. They are then sold as scrap metal. A government official must accompany such scrap and stand by until it is melted in the purchaser's furnaces. The metal is then recast into such things as window-sash weights.

Peanut machines are harder on pennies than anything else. The salt sifts down onto the coins, corrodes them, and turns them green or black. Frequently, newly-minted pennies, used in such machines, find their way back to the mints after less than a year of circulation.

Texas Indian Bones Show Disease Was Common

The popular idea that the ancient Indian was an extremely healthy and strong person was exploded by a report made by Dr. Marcus S. Goldstein of the U. S. Public Health Service on the bones of early Indians of Texas.

Three out of 10 of adult skulls and 4 out of 10 adult skeletons showed signs of diseased conditions, defects or injuries, including fractures.

Children, despite their early deaths, had healthier bones, Dr. Goldstein told the meeting of the American Association of Physical Anthropologists. Only 18 percent of their skulls and 6.5 percent of their skeletons were damaged or diseased.

In general, the bone defects increased with advancing age except for a condition of abnormal porousness of the skull bones. This was most prevalent in the skulls of children.

• You'll continue to be attracted by the opposite sex, but you'll be less likely to talk about sex
• You'll have more confidence and self-assurance.
• You'll find crowds and loud parties less attractive.
• You'll be more likely to lay your cards on the table. Young people like to keep others guessing.

LIE DETECTOR MAY SHOW INNOCENCE, NOT GUILT

An upward swing of the record of a lie detector (polygraph) may point to innocence, not guilt So warned Richard O. Arther, of the New York Laboratory of John E. Reid and Associates.

This instrument is sometimes used by police in the investigation of crime It records the suspect's blood pressure and breathing rate as he answers a series of questions about the crime and other questions which are not "loaded."

Investigators have thought that if the questions about the crime caused a sudden rise in blood pressure, that would point to the suspect's guilt.

It may indicate just the opposite, Arther reports in the *Journal of Criminal Law, Criminology and Police Science.*

He suggests certain tricks to avoid being misled by the lie-detector records. One device is to put in a question about a purely fictitious "crime." If the suspect's blood pressure goes up when he answers this question, as well as the question about the real crime, it indicates he is innocent

If the suspect's blood pressure goes up in response to a control question (about whether he has been guilty of any other crimes) and the rise at this point is greater than the rise on questions related to the crime being investigated, this is strongly indicative of truth telling.

If the suspect's breathing rate is normal on the crime questions but speeds up on the control questions, this is suggestive of truth telling, even though the blood-pressure record would otherwise point to guilt.

—Science Service

PLAY IS PSYCHIC VITAMIN

Play is called a "psychic vitamin" by a psychiatrist reporting to the *American Journal of Psychiatry.* Just as lack of the vitamins in human nutrition causes deficiency diseases, so lack of play in a child's life, he says, may cause a neurosis.

Five different kinds of neurosis can develop in children, reports Dr. F. Schneersohn, director of the Mental Hygiene Clinic, Tel Aviv, Israel. They are home neurosis, loneliness neurosis, school neurosis, street neurosis and stranger neurosis.

Children suffering from ‹ neurosis can control their behavior when away from ' when strangers come in.' W' alone with the family, ' constrained or u.

give full rein to their nervous irritability.

In children with the school neurosis, just the opposite occurs.

Any of the neuroses may develop when the child cannot play naturally. The neurosis tends to fill the otherwise unbearable emptiness of the child's life.

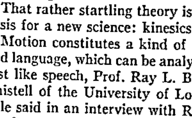
The remedy is to schedule the child's day to fill it with the needed play activity.

YOUR GESTURES GIVE YOU AWAY

Every gesture, every unconscious movement, is a dead give-away to your thoughts.

That rather startling theory is the basis for a new science: kinesics.

Motion constitutes a kind of second language, which can be analyzed just like speech, Prof. Ray L. Birdwhistell of the University of Louisville said in an interview with Ruth Dunbar of the *Chicago Sun-Times*. It provides an even more accurate index to thought than spoken words do, as it's harder to lie in kinesics.



Like accents in speech, gestures vary in different parts of the nation. But there is one universal American gesture (and only one), Birdwhistell explained—the nose-rub.

You may think you rub your nose because it itches. However, countless observation of American nose-rubbers has convinced the kinesiologist that the gesture means di- ment, objection or rejection.

Some gestures are fairly ob- like slapping the forehead ing "Boy, am I stupid.") or ing the fist ("That cinches it.")

Others are more subtle.

The stenographer sitting w crossed legs, swinging one foot, really expressing a desire to walk of the office. But if her foot curling around in circles, it she's thinking about a man, ing to Birdwhistell.

When a man adjusts his tie, meanwhile arching his brows and curving his lower lip, or when he tugs at the cuff of his shirt, he is saying by gestures that he is pretty well pleased with himself.

Every movement has a meaning, there is no such thing as an accidental movement. Birdwhistell insists. Although people are usually not conscious of it, they learn this language of gestures rather early during their lives.

• • •

Sometimes a gesture has *different* meanings in different countries—a situation which could lead to international misunderstandings. For instance, when an American pulls an earlobe or strokes his chin, he is thinking. But when an Arab strokes his chin, it means "there goes a pretty girl," while a Portuguese expresses that idea by pulling his ear.

PSYCHIATRISTS MUST BE FREE OF OWN WORRIES

The psychotherapist best qualified to allay the worries of his patients is

one who has the fewest worries of his own, says a Stanford psychologist after tests with 42 practicing psychotherapists.

Professor Albert Bandura chose three common types of human anxiety for his experiment—fear of dependency on others, fear of others' hostility and sex fears.

The effectiveness of treatment depends upon modifying or eliminating such fears in the patient, he said. The interview with the patient must focus directly upon these fears. The therapist's candid, matter-of-fact attitude in handling his patient's reactions is almost always essential for success.

If a therapist has strong fears of his own, however, certain patients may arouse them This could cause him to interrupt the interview with questions that change the subject, to make premature judgments that block further revelations, to be unnecessarily reassuring or unwittingly disapproving.

SCHOOLS, HOMES, INFLUENCE SCIENCE CAREERS

What makes a child or teen-ager suddenly annnounce: "I want to be a scientist!"

Is it an influence at home or school? Is it a talk with a friend, or a gift of scientific equipment? Is it a science club or just a personal drive?

It can be any one or all of the foregoing, and may also be due to none of them

This seeming paradox turned up in the answers to a questionnaire sent to finalists of the 1954 National Science Fair, conducted by Science Service's Science Clubs of America, writes Howard Simons of *Science Service*.

The young scientists were asked: "What or who sparked your first interest in science, and how?"

Of the 79 teen-age finalists who answered the question, 36.7 percent gave credit to schools and their teachers for triggering their first interest in chemistry, biology, physics, or other specialties.

The next greatest source of inspiration was home influence. Father turned out to be much more influential than he usually gives himself credit for being.

"My father," one youngster wrote, "would ask me questions and try to get me to argue on certain points, such as an object being every color except as it appears."

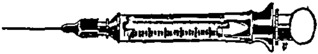
But father was by no means the only family influence.

"My older brother had been interested in astronomy but dropped it," another finalist said, "I read all of his books and began where he left off."

Giving a chemistry set as a birthday or Christmas present can do the trick, too, the report shows.

Others credited magazine articles and science clubs.

Deadly POISONS that SAVE Lives



by Joseph D. Wassersug, M.D.

In a day when "wonder" drugs and atomic miracles are commonplace, it is easy to forget some of the most potent medicines that physicians have today — medicines that began their careers as deadly drugs to be used in getting rid of enemies.

Today, poisonings are rare, largely because they are easily detected by chemical methods. But in the Middle Ages and Renaissance, poisoning was an advertised art for which the skillful professional was well paid.

In 1679, for example, poisonings were so common in France that a special judicial commission, the "Chambre Ardente," was appointed to take care of such cases exclusively. It functioned for three years, when it was finally abolished by Louis XIV. But in that short period of time, it had investigated 442 cases of poisoning in which the charge was sustained in 218 cases.

As a matter of fact, in those days people looked upon poisoning as one of the ordinary hazards of life. One of the most prominent of the poisoners was La Voisin, who conducted her killings on a "big business" basis which she derived an income of several hundred thousand francs a year. She confessed to over 2,500 murders by poisoning.

Even before the Middle Ages, however, mankind had sufficiently studied various herbs and drugs to learn of their lethal effects. That this was not confined to any one nation is evidenced by the fact that references to poisonous herbs appear in the literature of the ancient Egyptians, Hindus, Hebrews and Greeks.

Take, for example, the plant, *colchicum* or meadow saffron. This plant is a native of the temperate zones of Europe and North Africa, growing in moist fields and bearing a delicate lavender flower. Ancient Greek physicians knew of colchicum, and Arabian doctors of the 16th century prescribed it in cases of rheumatism. It then fell into disrepute because of its poisonous properties.

A few drops of colchicum placed in a glass of wine converted it into a deadly potion. The poisoned victim, soon after imbibing, would die complaining of cramps, vomiting and diarrhea. But, since diarrheas of this type were epidemic at the time, the poisoner hardly ever was detected.

It was not until the middle of the 18th century that colchicum was rediscovered. But it varied considerably in its potency and doctors never knew in advance whether their concoctions were too weak and ineffective, or too strong and deadly.

The creation of colchicine, the pure alkaloid, is due largely to the efforts of J. E. Carter of Philadelphia, who succeeded in obtaining 20 grains of pure colchicine from three pounds of dry colchicum root. Obtained this way, colchicine is a pale yellow powder, bitter in taste and nearly odorless. The average dose is 1/120th of a grain, or 0.5 milligrams. Today, 100 years after its purification, colchicine is used widely as an effective medication in the treatment of gout.

In the case of an acute attack of gout in which the patient is suffering the hellish anguish of joint pains, nothing, not even the hormone drugs, cortisone and Meticorten, surpass colchicine for speedy effectiveness.

When taken under a doctor's prescription, colchicine is entirely safe and effective Were it not for the early practitioners of poisoning, however, the usefulness of colchicine might never have been discovered. Meadow saffron might be growing all about us and the modern doctor would be totally unaware of its therapeutic possibilities

Another valuable medicine that has had a long and wicked history is belladonna, derived from a plant known as the "deadly night shade." Atropine, which is one of the most active ingredients in belladonna, can be found in several poisonous medicines. The word belladonna itself comes from the Italian, "handsome woman," because it was used to dilate the pupils and give luster to the eyes The word "atropine" comes from Greek mythology: Atropos, the eldest of the Three Fates, was the one who cut the Thread of Life

The first historical mention of belladonna is in 1504, when it came into use for both poisoning and cosmetic purposes Mixtures in those days were so crude and so variable in composition that some deaths from belladonna were undoubtedly accidental when the drug was taken for cosmetic reasons alone.

Unlike colchicine, belladonna is a slow-acting poison which can be fed to the victim little by little, causing obscure symptoms and a prolonged illness in which the victim would have little chance of suspecting poison. For over two centuries, its death-dealing properties were appreciated before it began to be realized that belladonna could be a valuable agent in medicinal therapy.

Today, tincture of belladonna, or one of its derivatives, is known to be an effective remedy in several conditions For example, in testing for eyeglasses, the eye specialist may place a few drops of Homatropine in the patient's eyes to prevent a spasm of the eye muscle and to paralyze accommodation. Homatropine is a chemical derivative of
first cousin to belladonna.
can question that eye care
improved since the
this method of testing.

In patients with peptic ulcer, in which there is abdominal pain and spasm, tincture of belladonna finds even greater usefulness. By slowing down the activity of the bowel and reducing the secretion of acid in the stomach, Belladonna is one of the most useful medicines a doctor has in helping the peptic-ulcer victim.

Most of the significant discoveries in the past 20 years that deal with bowel physiology have been based on the knowledge of the effect of belladonna on the bowel. Similarly, most of the newer medicines discovered to help ulcer victims have depended on belladonna and atropine for their chemical derivation and effect.

• The deeper insight any Man hath into the Affairs of NATURE, the more he discovers of the Accurateness, and Art, that is in the Contexture of Things.—*Sir Thomas Pope Blount (1693)*

Even the victims of Parkinson's Disease (shaking palsy) are benefited by stramonium, a remedy closely akin to belladonna.

Out of sudden death in the South American jungles has come curare, a medicine which is making anesthesia safer and which has lessened the hazards of shock therapy so useful in the treatment of mental disease.

Curare was brought to Europe by Sir Walter Raleigh, who discovered it on his voyage up the Orinoco River in 1595. But for the next 250 years, curare was only a chemical curiosity, known for suffocating victims to death.

The South American natives dipped their arrows with curare. When struck with a poison-tipped arrow, the victim, whether animal or human, became paralyzed. Small doses in human beings first caused a sensation of heaviness in the eyelids. Double vision then set in, since the muscles that move the eyeballs were paralyzed. With larger doses, the muscles of the neck became paralyzed, causing the victim to be unable to raise his head Finally, there was a sensation of suffocation with complete weakness and paralysis of the muscles of the back, arms and legs and, if the dose was lethal, the muscles of respiration were knocked out, resulting in death

It was not until 1860 that the French physiologist, Claude Bernard, discovered that curare's deadliness lay in its ability to interfere with the passage of impulses from nerve to muscle. It was found to be a motor-nerve poison acting on the filamentous endings of the nerves as they dip into their muscle fibers.

In 1938, an American scientist and explorer, Richard Gill, returned from Ecuador with specimens of the various plants used by the natives in the manufacture of crude curare. Dr. A. R. McIntyre, professor of pharmacology at the University of Nebraska's college of medicine, after many experiments, purified curare to a point where it was ready for clinical trial.

Nowadays, doctors not only have pure curare, but they have many curare derivatives and curare-like substances that are valuable in relaxing the patient who is undergoing abdominal surgery in which the sur-

geon desires to keep the patient as restful as possible without making the anesthesia too deep.

More important than this, however, is the fact that with an injection of curare, a patient who requires electric-shock therapy can now be treated without being subjected to the violent, convulsive seizure that so often accompanies this type of therapy. Whereas fractures of the spine were, not long ago, fairly common in mental patients treated with electric-shock therapy, they are nowadays a rare complication.

Even morphine, which is so valuable in allaying pain of cancer victims or quieting the fright of a wounded soldier, and which has been called "God's own medicine," began its life as one of man's most deadly poisons.

The origins of morphine have been lost in antiquity, but Dioscorides, writing as far back as the second century, gave full directions for preparing opium from the poppy. His method, strange as it may seem, has remained virtually unchanged since then.

For the medieval poisoner, opium —from which morphine is derived— had a two-way advantage over other toxic drugs in that it could produce chronic poisoning if given in small amounts, or could cause death in from 2 to 12 hours if administered in larger quantities. Here, too, the cause of death did not have any special characteristics that identified the victim as having been poisoned.

As a matter of fact, in the modern-day laboratory, morphine poisoning is more readily detectable by chemical methods than it is by any characteristic effect that the drug has upon tissues. It is easier for the biochemist to detect morphine poisoning than it is for the pathologist to do so.

Yet today, what was once one of mankind's most deadly poisons has become the patient's best friend. Were doctors to gather in groups to discuss which drug would be most helpful to humanity, if only one drug could be chosen, it is practically certain that morphine, would be the No. 1 choice.

In spite of many attempts by modern organic chemists to synthesize a drug more valuable than morphine, it is still the one medicine that can be counted on when a doctor needs it most. As one medical authority put it, "Modern man has purified it in a glass ampule; but he has been at a loss to improve it very much and there the ampule is, in the bag, alongside what are now routinely known as wonder drugs."

And so the long history of medical science goes. Other drugs, such as the salicylates from which aspirin is derived, and quinine which is so useful in combating malaria and other fevers, were known to ancient physicians either as medicinal remedies or as poisons for dealing with one's enemies.

Another curious remedy, picrotoxin, which is a most powerful antidote for phenobarbital [illegible] was known long ago to the [illegible] of the East Indies. Certain [illegible] were gathered, crushed,

thrown into the water. The fish ate the crushed berries, became prostrated and floated to the surface where the fishermen collected them with a rake. It is from these fish berries that the modern doctor gets the picrotoxin he needs to revive the patient who has taken an accidental or a suicidal dose of phenobarbital

Perhaps all of this has a modern analogy. Man seems bent on destroying his enemies with his discoveries before he uses them for peaceful purposes. Thus the atom bomb may yet be forgotten as an instrument of war and hostility, and serve only the kindlier and happier ends of mankind in much the same way as the fish berries, opium, belladonna and meadow saffron do today.

Drunken-Driver Tests Called Too Kind

A Yale scientist recently said the nation's vehicle laws, in trying to be scientific, are too kind to the drunken driver.

Doctor Leon A. Greenberg, acting director of the laboratory of applied physiology, called for a drastic revision of the uniform motor vehicle code that brands a driver as drunk if he has .15 percent alcohol in his blood.

"The percentage may sound innocent to the layman," Greenberg said, "but it means the driver has the equivalent of a half-pint of 90-proof whisky in his body, and that makes him a menace on the road."

Greenberg was a member of the committee which wrote the alcohol part of the vehicle code 15 years ago and since then has developed the alcometer, a device in wide use by police departments to measure the amount of alcohol in a suspect.

To get the first scientific standard of drunkenness adopted, Greenberg recalled, the committee set a very generous limit. Now that the code is used by about one-third of the states, it is time the standards are tightened.

The uniform code, Greenberg said, presumes a man sober if his alcohol level is below 05 percent. From 05 percent to .15 percent there is no presumption and only over .15 percent is the driver presumed to be under the influence.

He pointed out that in Scandinavian countries, where chemical tests for [illegible] under the [illegible]

or three 12-ounce bottles of beer.

Greenberg pointed out that drinking is involved in at least 20 percent of fatal highway accidents. He said the law should be stiffened to make an alcometer reading of 1/10th of 1 percent evidence of driving under the influence

[illegible] pre- [illegible]

who is staggering, confused and does not know what he is doing rarely drives, he said.

"A drunk probably couldn't get the key into the ignition," he said. "He's satisfied. He doesn't want to go anywhere; he's arrived.

"The dangerous one is the driver who has taken on enough alcohol to impair his faculties and affect his judgment He may not look drunk and can pull himself together if challenged by a cop but he is the real menace on the highway."—*Chicago Sun-Times*

new light on the COMMON COLD

Condensed from Newsweek

WHAT IS THIS "common cold?" Actually, there is no such thing. Today, "a virus infection," or more simply, "a virus," is the layman's pat term for any number of respiratory symptoms, such as chills, fever, stuffy or running noses, sneezes, and coughs. In some instances, the sufferer may have no cold at all, but an allergy, with symptoms resembling a "true" cold.

The patient who complains of a "cold" may have influenza, or grippe, which starts with a sudden chill, high fever, aching bones, and general prostration. Alternatively, he may have "intestinal flu," with nausea, vomiting, and severe cramps, lasting for two or three days and leaving him weak and wobbly.

The respiratory infection may be pneumonia of the lobar (lung) type, once a dangerous killer, now robbed of its sting by powerful antibiotics. "Too bad you haven't pneumonia," a doctor told his patient. "I could cure it with penicillin or terramycin. But there's no specific cure for the common cold."

Finally, the patient may have a psychological cold. The nose reacts sensitively to emotional tantrums; the nasal passages close; the delicate membranes swell, and the nose runs freely. Before he knows it, the upset person has a full-fledged respiratory infection.

Whatever this ubiquitous ailment is called, it is as common as it is contagious. Two out of three people have three attacks a year, costing about $25 apiece. Women catch cold more easily than men;
der 10 have about twice as
the age group over 20. F
more sensitive to colds
door workers. There are
among office personnel

Newsweek, Newsweek Building, Broadway and 42nd St., New York 36, N. Y.

workers and fewer attacks in air-conditioned offices and plants. People who live in the mild coastal areas have fewer attacks than those in sections where the seasonal variations in temperature are greater.

Some doctors believe that wintry weather brings on colds, because people shut themselves in warm stuffy rooms, perspire freely, then go out in the cold without proper protection. This much is known: The largest number of colds occur in October. There is a second peak in January and February, and a third in blustery March. But intensely cold weather does not cause colds. Eskimos seldom have respiratory troubles unless they contract them from visitors who have these infections.

How much have the doctors learned about colds? They now know that colds are transmitted by a virus—or a group of viruses—so small that they pass right through the finest filters. It is only in recent times that doctors made even the barest progress in tracking down this virus. Walther Kruse, a German scientist, in 1914 pinned the common cold on a virus source. In 1936, Dr. A. R. Dochez of Columbia University and his associates succeeded in growing the virus in the chick embryo.

By passing this small cold "bug" through filters with holes of different sizes, Dr. Christopher Howard Andrewes of Salisbury, England, one of the world's foremost experts on the common cold, has measured the size of the virus. Smaller than the influenza virus, but larger than that for polio, the cold virus is about 2 millionths of an inch in diameter. It has never been seen, however, not even under the powerful electron microscope.

Through the years, cold-research progress has been unusually slow and tedious. The chimpanzee is the only animal besides human beings susceptible to colds. The chimp costs about $600; he is temperamental about being used in cold experiments; and he is likely to catch pneumonia along with the cold. So researchers have had to rely mainly on human volunteers to test their theories.

Recently, for the first time in recent medical history, some significant progress on the cold front was reported. Two groups of researchers have been most active—one led by Dr. Robert J. Huebner in the U. S.; the other, by Dr. Andrewes in England.

Doctor Andrewes and his group work in the old cathedral town of Salisbury, 82 miles southwest of London, in a group of buildings high on a windswept hill, erected by the Harvard Medical School and the American Red Cross and donated to the British Government. Since May 1946, when the Cold Research Institute was established at the original Harvard Hospital, some 4,000 volunteers (about 1,900 men and 2,100 women between the ages of 18 and 45) have served in the British experiments.

Each volunteer spends two weeks at the institute (ten days in isolation

in pairs), while Dr. Andrewes and his staff try to give them "colds" in various scientific ways. In return, they receive traveling expenses, a comfortable room with private bath, telephone, radio, three meals a day, and 3 shillings (about 42 cents) a day pocket money for newspapers and cigarettes.

On a typical Wednesday, a group of 24 subjects arrives at Salisbury at noon. They are immediately examined for signs of colds. After lunch, with members of the staff, the project and their part in it is explained in detail. They are assigned to quarters, two to a flat in a comfortable prefabricated hut. From then on, the pairs must remain in complete isolation, except for daily visits from members of the staff, who are thickly and sterilely masked. They may go out for walks in the hills, but only alone, or with their flatmates, and with the promise that they will not go nearer than 30 feet to any other person.

• Diagnosis holds the first rank in our science and is the most difficult part of it, without an exact and precise diagnosis theory is always faulty and practice often incorrect — Guillaume Dupuytren (1777-1835)

For the first three days, no medical techniques are used on the volunteers. On Saturday, the inoculations take place, usually of three types: "Positive," consisting of nasal washings from cold victims, and expected to produce a cold; "experimental," *an inoculation based on the Institute's* effort to produce the cold virus artificially in test tubes, and the third, a harmless, sterile solution, used as a control.

The experimental colds produced at Salisbury are usually mild, rarely with fever. They generally last about a week. In studying them, the Salisbury researchers have found that colds are spread by direct person-to-person contact and by droplets of infected nasal discharge.

Doctor Andrewes and his associates have been surprised to find that about 50 percent of the volunteers do not catch cold, in spite of the intensive exposure to the virus. Another discovery is equally puzzling. Exposure to wetting, chills, and drafts had no effect whatever on the Salisbury volunteer subjects.

This new knowledge about the common cold is valuable, even if most of it is pretty negative. But the principal aim of Dr. Andrewes and his group is to learn how to cultivate the cold-virus artificially, so that it can be produced in quantity and studied in the laboratory instead of in the nasal passages of human volunteers. Until 1951, they had failed completely. Then the new technique for cultivating polio virus in test tubes, invented by Dr John Enders of Harvard University, and later responsible for the Salk vaccine against this disease, was announced. The Salisbury scientists were soon growing the common-cold virus in tissue *cultures of the human lungs.*

In spite of this major research achievement, the Salisbury virus cultivation process is f· perfect. "We get some sults, but also plenty of

is Dr. Andrewes' rueful comment. Until they can produce the cold-virus in test tubes on a large scale, not yet possible, the British technicians will be a long way from the major question, which underlies all their work: "Can an anti-cold vaccine be developed?"

In the United States recently a group of excited scientists at the National Institutes of Health of the United States Public Health Service, Bethesda, Md., were ready to say that a *vaccine can be made.* Dr. Huebner, the hardworking chief of the cold-research committee at Bethesda and Johns Hopkins, admitted that "a break had finally come"

Doctor Huebner and his associates have discovered six types of respiratory viruses in tonsil and adenoid tissues taken from patients undergoing surgery. These, said Dr. Huebner, may account for "a substantial part of all respiratory infections" which people regard as "colds." So far, they have used these viruses to build up antibodies in human beings.

Success for the USPHS scientists did not come in a day. Whenever they though they had cornered the cold-virus, it would disappear from their test tubes. Like their Salisbury colleagues, they had succeeded in growing the cold-virus in eggs. But the organism was so fragile that it could not be kept alive.

Then Dr. Huebner and his team, including scientists at Johns Hopkins, "saw a ray of light." Using the Enders technique, they were able to cultivate the common-cold-virus in human tissue in test tubes, and to drop their animal experiments.

At the big Bethesda institutions, USPHS researchers gathered bucketfuls of adenoid and tonsil tissues, cleaned them with antibiotics to destroy the bacteria, and then dosed the tissues with cold-infected nasal discharges. To their amazement, the untreated tissues showed the same effects as the cold-infected material In other words, even the supposedly pure tissues were growing viruses. [illegible]

two potent viruses, which their former owners must have harbored for a long time. They were named APC (adenoidal-pharyngeal-conjunctival), or virus strains 1 and 2. By checking antibodies in the blood of a number of human beings, the researchers found that nearly everyone had had infections from these two APC strains.

Next, Dr. Huebner's group, together with Dr. Thomas G. Ward of John Hopkins, found a related APC virus, which they named Type 3, in the throat of a prisoner volunteer at the Maryland State Reformatory for Males near Hagerstown. This bug produced a strange infection—a "cold" with red eyes. When several workers at the National Institutes of Health came down with the telltale "red-eye colds," swabs from their eyes revealed Type 3.

At about the same time, Dr. Maurice Hilleman of the Army Medical School, Walter Reed Hospital, Washington, D. C., turned up a similar

APC cold virus, Type 4, presumably the prolific cause of a respiratory epidemic at the Great Lakes Naval Training Station. Later, the collection of APC strains was brought up to date with the discovery of Types 5 and 6 in the Bethesda collection of tonsil and adenoid tissue.

Out of this work, Dr. Huebner has formed a new concept of the "common cold." "The way we look at it here," he said, "this is a problem of multiple respiratory diseases caused by several different agents. The problem will not be solved by taking up arms against a fictitious thing called 'the common cold.'" The six APC strains may account for "a substantial part of respiratory infections." If a multiple-strain vaccine, containing all six viruses, could be developed, "a large slice of the coldlike illnesses could be prevented."

Now, in the USPHS laboratories, Dr. Huebner and his team are pushing hard for such a vaccine. Prospects are encouraging, Dr. Huebner explains, because: (1) tests show that human beings definitely develop antibodies to these six viruses; (2) raw material for the vaccine can be grown in large quantities in the laboratory, and (3) the six APC infections occur on a large enough scale to make a vaccine worthwhile. To broaden this vaccine research, Dr. Huebner already has sent a batch of his APC tissue material to Dr. Andrewes at Salisbury.

Until the cold virus reveals itself to the human eye through an electron microscope, Dr. Huebner is cautious about describing it. But as things stand now, it seems likely that a workable vaccine against six cold-virus strains will be ready for use long before the virus itself is glimpsed through the microscope.

Until the new "cures" are announced, what can be done about the current plague of colds? There is still no official "cure," declares the American Medical Association. "No known pill, salve, gargle, or nose drops can help to cure this malady."

Unfortunately, complete rest, the best treatment for a cold, is too "simple" a cure to be popular.

"That Darned Atom Smasher"

Power from the atom is a popular topic these days. It's a switch, however, when someone complains about getting less power because of atomsplitting. Yet this was the complaint handed to a hungry visitor attending the American Association for the Advancement of Science meeting at Pasadena, Calif.

The visitor had gone into the Caltech campus coffee shop for a quick-toasted tuna sandwich His quick sandwich was a long time in arriving, however. Wondering about the delay questioned the shop's manager, Fl ence Lyall.

Her answer: "That darned smasher here saps all the and slows down the electric

—*Chemical and F*

Vitamin Treatment for Athletes' Bruises

A before-and-after treatment to reduce the bruises and black-and-blue marks of athletes engaged in football, soccer, lacrosse and other contact sports has been announced by Dr. A. Lee Lichtman of Manhattan's Polyclinic Hospital, New York

The before-bruise treatment consists of doses of ascorbic acid, or vitamin C, and hesperidin, a chemical found in citrus fruits This, Dr. Lichtman believes, will strengthen the walls of even the smallest capillary blood vessels. A bruise, he explained, is chiefly a mass of damaged capillaries which let blood leak into surrounding tissues. The leaked blood gives the black-and-blue discoloration

The after-bruise treatment consist of injections of the enzyme, tryps This is given immediately after th bruise-causing blow, or as soon after as the rules of the game permit. Tryps in some still unexplained way, move rapidly to the affected area to revers the inflammatory process.

With this treatment, bruises that or dinarily would be painful for ten d "subside almost overnight," Dr. Licht man reported. He said unusually ba bruises are over in three days inste of two weeks.

The treatment was given to 124 ath letes who suffered bruise-causing blow Results were excellent in 85, Dr. Licht man reported, and good in 36

Predict Midwest Drought's End by 1957

Sixty-year weather forecasts now are possible—probably for any place in the country for which sufficiently detailed local records are available Such forecasts will predict general trends, although owing to unpredictable events such as volcanic eruptions, they may be quite wrong for particular years.

This is the contention of Dr. Charles G Abbot, former Secretary of the Smithsonian Institution. Dr. Abbot has predicted, both backward and forward from the year 1897, the rainfall in St. Louis for a century, and then checked with the actual Weather Bureau records. For 70 out of 100 years he ca quite close to actual conditions T failure in 30 years is explained as d to such events as the eruption of t volcano Krakatoa, which filled the a mosphere with dust for about eig- years, and the world wars with their bombing.

His present prediction is that the drought which has afflicted the Midwest since 1952 will have ended by 1957. Dr Abbot hopes that eventually the method will be used to map the areas of high and low rainfall over the whole country for years to come.

How To Make a Million

by *Joseph Nolan*

Condensed from The New York Times Magazine

THE LATE man-about-resorts, Alexander Phillips, bemoaning the decline of moneyed society in the United States, once complained: "The '400' has been marked down to $3.98." Now the Internal Revenue Service has come along with a further markdown—to 148. That, say the revenue officials in a report just published, is all we have left in the way of real millionaires; that is, men and women with incomes of $1 million or more a year. In 1950 there were 219 in the million-dollar-a-year class, and back in 1929 before Wall Street's graphs went through the floor there were 513.

Millionaires, of course, come in all shapes and sizes. There are the little ones who, perhaps after almost a lifetime of labor, have just barely managed to amass a million dollars worth of property, stocks and bonds, and cash. They are big wheels only in their local communities, and for them life is often a race to keep up with the Vanderbilts.

Then there are those with net assets of $5 to $10 million, many of whom have inherited money and invested prudently. They can live comfortably these days provided they don't splurge on things like overly fancy yachts. (J. P. Morgan told an acquaintance who inquired about the upkeep on a yacht: "If you have to ask, you can't one.")

Then, there are those with nual income above a millio

get into this select bracket only now and then, possibly in a year when they sell an oil well or a uranium mine; others have a million dollars coming in every year and these are the big rich. It is the million-a-year group that the Internal Revenue report discusses, statistically but namelessly, and says is getting smaller all the time.

However, this situation is not quite so alarming as it might appear on the surface, according to financiers, investment counselors and tax specialists. Styles change, they point out, in millionaires as in millinery. The massive fortunes of the "Pittsburgh millionaires" of the 19th century and the "Detroit millionaires" of the Twenties are a phenomenon not likely to be repeated.

But, say the authorities, a fellow with energy, imagination and luck can still scrape together a modest million or so in the course of a lifetime if he knows the ground rules and takes advantage of them.

Financial experts do not see eye to eye on many things these days, but they do agree generally on these three points:

• Part 1. *It is harder to make a million now than it was 40 or 50 years ago.*

Five times as hard, in the opinion of Bernard M. B[illegible]

was 30, amassed a fortune once estimated at $25 million.

Laurance S. Rockefeller, chairman [illegible] board of Rockefeller Center [illegible]andson of the first John D., once remarked: "We just don't have money the way people used to have it." Actually, not many people ever had money the way Grandfather John D. used to have it. Guesses on the size of his wealth ran up to $[illegible] billion, and one statistician figured at the turn of the century that if his money were left to accumulate at the going rate for 30 years, it would amount to $90 trillion.

Statistical support for the theory that it is tougher to make a million these days is provided in a study recently completed by the Tax Foundation, a private, non-profit research organization. It is a hypothetical case-history of two men going into the same kind of business, with the same capital ($150,000), and the same rate of return (33⅓ percent) at two different periods.

Mr. A started in 1920, Mr. B in 1955. After the first year their books looked like this:

	Mr. A.	Mr. B.
Original Investment ..	$150,000	$150,000
Return on Investment ..	50,000	50,000
Net Income (after 10 percent deduction for expenses) ...	45,000	45,000
Federal Taxes..	7,680	16,64[illegible]
Income after Taxes	37,320	28,35[illegible]
Living Expenses	15,000	24,000
Profit Reinvested	22,320	4,352
Added to Original Investment Makes	172,320	154,352

At this rate, Mr. A, the 1920 man, would have run up his original stake to $1 million in just 11 years Lower tax rates and a lower cost of living would have permitted him to plow back into his business a sizeable portion of each year's income.

On the other hand, Mr. B, the 1955 man, would have found that at the end of 11 years he had increased his investment to only $239,933. It would have taken him 34 years altogether, taxes and living costs being what they are, for him to amass his million.

• Point 2. *Chances are strongly against anybody's making a million in his lifetime by depending on salary alone*

In 1900 when Andrew Carnegie earned $23 million from his vast steel enterprises, he paid his chief lieutenant and golfing partner, Charles M. Schwab, a salary of $1 million. Not only did Schwab have no federal income tax to pay, but his dollar went about three times as far then as it would now.

"Today," says comedian Bob Hope, "the dollar goes a long way, too — all the way to Washington, D. C. But in the old days you were allowed to feel it, see it, even to use it." In the higher income brackets the tax collector now takes up to 87 cents out of every dollar. So no companies are paying million-dollar salaries any more.

Industry's highest-paid executive is Harlow H. Curtice, president of General Motors, who collected $686,000 in salary and bonuses last year. Though actual income tax returns are confidential, it is possible to figure out very roughly from a tax-rate schedule that the federal government's claim on Curtice's income would amount to something like $595,000.

A further indication of the futility of depending on salary alone to make a million is found in the Internal Revenue report on the 148 million-dollar-a-year men and women. Salaries accounted for less than 2 percent of their total incomes. They got almost half their money from dividends and another quarter from the sale of assets at a profit.

• The two greatest inventions of the human mind are writing and money—the common language of intelligence and the common language of self-interest
—Marquis de Mirabeau

• Point 3. *A person's best bet for making a million is to take advantage of some of the "gimmicks" that are available.*

There are dozens of these "gimmicks," but here are three that the experts say have been responsible for making many of the "new" millionaires.

Capital Gains Deals Capital gains are the profits a person gets by selling stocks, bonds, land, houses or other property — not a part of his stock-in-trade—for more than they cost him.

Suppose a man, reading that burlesque is on its way back to New York, invests his money in a theater. Burlesque proves to be such a hit that the man finds he can sell out six months later at a profit of $100,000 If this profit were taxed as ordinary income he would have to pay

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Suppose a man, reading that burlesque is on its way back to N York, invests his money in a Burlesque proves to be su that the man finds he six months later at a pro 000. If this profit were nary income he would

the federal government $66,798. But by taking advantage of the capital gains tax he can get off by paying only $25,000.

This tax concession, under which assets held for at least six months can be sold and the profits taxed only 25 percent, was put on the books to induce people to risk their capital. The result has been to give many an enterprising fellow a few dollars he can call his own. For instance, Vernon Pick, the first of the successful "amateur" uranium prospectors, became a millionaire on the strength of this "gimmick." He sold his Utah uranium mine last year to an investment company called Atlas Corporation for $9,370,000 and was able to keep 75 percent of his take.

Depletion Allowances. These have been called "capital gains with a Texas twist." Because of the risks involved in drilling for oil—$100,000 or more to sink a well that often will turn out to be dry—the government allows oil men to pocket 27½ percent of their gross income before paying a cent of taxes. They can continue these deductions for the life of their oil wells and can also write off large sums as "intangible development" costs.

This tax bonanza has produced a fabulous number of Texas millionaires (50, it is said, from Henderson County alone) and equally fabulous stories of their antics. Like the one about the Houston oil man who, glancing over his new six-car garage and seeing only five pairs of fishtails sticking out of the stalls, told ... uffeur matter-of-factly: "Buy me another Cadillac to plug that hole." Not long ago, one Texan brushed off a rival with the crack, "That guy never had more than 40 or 50 million to his name."

Texas' best-known oil millionaires are Sid Richardson and Clint Murchison. (Of his fortune, Murchison says: "I don't know how big it is; I try to have fun out of business, make it a hobby instead of drudgery.") Reputedly wealthier than either of them, though, is 66-year-old Haroldson Lafayette Hunt, whose estimated million-dollar-a-week income makes him, in many an expert's book, "the richest man in the United States."

Stock Option Plans. The story is told of a board meeting at which the president of a large corporation was being badgered about a poor performance in one of the company's divisions. Someone suggested that the vice president in charge of the division be called on the carpet. "I can't chew that guy out," said the president. He became a millionaire last week." During the past five or six years of the bull market, dozens of vice-presidents have become millionaires — through stock-option plans.

The plans work like this: To give a key man some additional reward that will not be grabbed up by the tax collector, a company offers him an option to buy 10,000 shares of stock at $50 a share. That is 5 percent below the market price of the stock. The executive has, say, five years to make up his mind whether he wants to buy.

A year later, the stock has gone

up to $75 a share so the executive borrows money and buys it. He pays not the regular price of $75 a share but the originally agreed on price of $50. So he already has a "paper profit" of $250,000. Two years later, the stock is up to $150 a share. The company decides on a stock split of two shares for one. The executive now has 20,000 shares, each share being worth $75 on the market after the split.

In another year, the stock is up to $125, so the executive decides to sell his 20,000 shares at this price. All told, he gets $2,500,000 Allowing for his original stake of $500 000, he has a profit of $2,000,000. On this he pays a capital gains tax of 25 percent. That leaves him $1,500,000 in the clear.

These and other "gimmicks" are helping many today to realize the American dream and ambition of "making a million" Most of them don't make it—or keep it—in a single year, but they get it eventually Few of them are wealthy enough to be mentioned in the same breath with the Fords or the Woolworths or the Astors.

But if they are just plain, garden-variety millionaires and not the super-millionaires of yesterday, they can perhaps take some consolation from old John Jacob Astor, who said "A man who has a million dollars is as well off as if he were rich."

Operation Makes Rabbits Temporary Sheep-Mothers

Three British scientists have succeeded in making rabbits into temporary mothers of sheep

Eggs from pregnant sheep have been transferred into female rabbits where they continued to develop normally for at least five days, report R L W. Averill, C E Adams, and L E A Rowson with the Agricultural Research Council at Cambridge, England

While normal cleavage of the transferred sheep eggs continued in the uterus and Fallopian tubes of the rabbit foster mothers, rabbit eggs in the same organs failed to develop.

Their findings show that the successful transfer of mammalian eggs from one species to another is not necessarily tied to the animals' ability to breed.

For the experiment, the researchers removed 18 eggs from the 2-cell through the 12-cell stages of development from sheep and transferred them to the Fallopian tubes of pregnant rabbits Four to five days later, they dissected the rabbits and found 9 of the sheep eggs attached to the uterus or Fallopian tube walls, all with normal development

Two of the sheep eggs from rabbits were re-transferred into a female sheep Sixteen days later, she was dissected and two normal embryos were found

There are two immediate practical uses for their discovery, the scientists said. 1 They hope to use their nique as a test of viability of shee in the earliest stages; 2. Rabbi now serve as "incubators" for distance transport of fertili eggs

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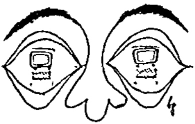
DOES TELEVISION HARM EYES?

The newest studies on the effect on the eyes of viewing television show that no harm occurs to normal vision, if the picture is in clear focus and the viewer sits at a proper distance.

After many hours of televiewing, however, a person's eyes may become tired—just as his legs will become tired after a long walk. "The solution is simple," says a pamphlet issued by the National Society for Prevention of Blindness. "Just give your eyes periodic rest periods."



You can't "wear out" your eyes by looking at TV, the pamphlet explains. But often a person with a minor eye defect—such as nearsightedness — may discover he needs glasses after watching television. He would have found that he needed glasses if he started going to the movies every night. The eye defect already existed. Television did not cause the trouble.

The Society recommends: Use soft, indirect light. Never watch television in a completely darkened room. Stay as far from the screen as visual comfort permits. The farther away you sit, the less the eye muscles have to work at focusing the image ' see. There is no danger from "X rays or radiation" from a television set.

SALT A FOOD, NOT A MEDICINE

Many people have somehow confused salt with therapy. They make their eating a chore rather than a pleasure by restricting their salt intake.

There may be some medical indication for reducing salt in the hope of lowering blood pressure or easing the burden on a weakened heart by ridding the body of some of its excess fluid.

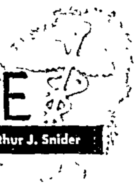
But this must be done under a physician's supervision, says Dr. Wright Adams of the University of Chicago, and should offer no sound basis for the current "fad" that sees misguided Americans juggling their own salt intake.

Many people think of a low-salt diet as one that can be achieved simply by avoiding the salt-shaker and staying away from obviously salted foods.

If you did this—used no salt in home cooking and avoided nuts, popcorn, potato chips, salted meats, soup, gravies, sauces and the like—your intake would be cut to about 5

SS

CINE



by Arthur J. Snider

grams a day (⅛th of an ounce). This diet would have almost no effect on high blood pressure.

The diet doctors use in treating the disease drops the intake to about 3 grams of salt. It eliminates milk, baked goods, crackers, cheese, carbonated beverages, many vegetables, ocean fish

People who find themselves getting fat and seek to reduce by cutting salt also are deluding themselves, Dr. Adams says. They might drop their poundage temporarily by eliminating water, but they lose no fat.

STEROID USED AS SURGICAL ANESTHETIC

The first successful use of a steroid compound as a surgical anesthetic is reported by Drs. Gilbert S. Gordan, Jr., and Frank J. Murphy, University of California.

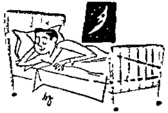
A steroid is in a class of compounds represented by cortisone, the sex hormones and cholesterol.

The new agent, known as Viadril, is expected to open a whole new area in anesthesiology, the doctors said. It can be used with greater margin of safety, produces smoother, more even anesthesia, has less effect on breathing than other anesthetics, induces muscular relaxation, and promotes faster recovery.

OPERATION WRAPS "JITTERS" IN COTTON

A "cocoon operation" to take the "*tension out of hypertension*" has been developed by Dr. Sherman A. Eger, Jefferson Medical School, Philadelphia.

It is based on the idea that one important cause of high blood pressure (hypertension) is emotions acting through the adrenal glands Under nervous stress the individual's adrenals pour pressure-elevating chemicals into the bloodstream.



The new operation blocks this process by cutting the 20 or more nerve pathways that lead to the adrenals. To make sure the nerves do not grow together again, the doctor completely wraps each of the two adrenal glands in a ½-inch-thick "cocoon" of cotton.

The cotton is eventually absorbed, forming scar tissue through which the nerves cannot grow again

To select patients that are most likely to benefit, Dr. Eger
vised a "sleep test." Patients
to sleep for eight hours under
tive called sodium amytal.

blood pressure drops to normal during sleep, the patient is considered a good candidate.

DEVICE PICKS UP HEART'S FAINT SOUNDS

Low-frequency vibrations of the heart, which neither the human ear nor a physician's stethoscope can hear, now can be seen on the Stethograph developed by the Medical College of South Carolina and General Motors Research Laboratories Division.

The device was developed by mating part of a stethoscope, the medical profession's traditional listening device for heart and chest sound, with the supersensitive pickup of the Surfagage, used in machine shops to measure roughness on such highly machined auto parts as gear teeth and cylinder bores.

This combination gives physicians a high-fidelity record of the heart's sounds and vibrations. Its sensitivity can be compared with that of a seismograph, which records faint earth tremors.

Doctor Dale Groom of the Medical College of South Carolina said the heart's inaudible sounds can now be seen either with an oscilloscope, which resembles a miniature TV screen, or a direct writing device that records wavy or zigzag lines with pen and ink.

Medical researchers believe t low-frequency tracings or patter will offer new clues to the heart's be havior.

HONEY FOR A HANGOVER

Honey has been found to be on of the best treatments for acute in toxication, a doctor says in the *Jour nal of the American Women's Medi cal Association.*

Honey contains a large amount o fructose which has been found t promote the chemical breakdown o alcohol, says Dr. Martha Brunne Orne.

The fructose-alcohol reaction al has a sobering up and sedative effe on the patient.

CHOKING ACCIDENTS IN CHILDREN

Hurried eating is one of the mo frequent causes of choking in chi dren, says Dr. Lawrence R. Boies o Minneapolis.

Lack of concentration on the bus ness of eating is another. The chil whose attention is distracted b other children as he eats or who at tempts to play is an excellent candi date for a choking accident.

Allowing a small infant to play o crawl where there are small objec within reach that he could put in hi mouth provides a good setting, D Boies said. Pins of various type nutmeats, popcorn kernels, bead buttons, eggshells, pieces of woo and parts of toy musical instrumen have all been removed from th windpipe or bronchi of babies.

The time-honored practice of tur ing the child bottom side up an

slapping him on the back of the chest seems to work in a fair percentage of cases and seems logical, Dr. Boies says in *Modern Medicine.* It uses the force of gravity and at the same time stimulates the cough reflex.

Another maneuver that has some merit is to incite gagging so as to cause vomiting by sticking a finger down the throat.

PLACEBOS ARE "ETHICAL DECEPTION"

The doctor who gives a patient a prescription for "blank" pills to help him overcome imaginary ills is using an accepted therapeutic device, according to the late Dr. B. D. Senturia, who was chief of treatment, West Side Veterans Administration Hospital, Chicago.

Known as a placebo, the blank cartridge is a form of suggestion. Depending on the art with which it is presented, it can reduce pain, induce sleep, relieve anxiety and increase appetite.

Its use may be deceptive in that the patient is led to believe he has been given a substance of inherent value, but it is for the patient's welfare, Dr. Senturia thought, and as such is entirely ethical.

Placebos also are helpful in situations where a patient has long been taking a conglomerate assortment of drugs which have confused his medical picture. The physician can stop the drugs and instead order a placebo to satisfy the patient until tests are completed and a diagnosis made.

They also are useful i cancer cases where there is no hope after all known treatment is tried. Rather than permit the patient to think he has been abandoned, the doctor may continue to give the harmless pills.

PEPTIC ULCERS INCREASING IN ARMY

There is a growing number of peptic ulcer cases in Army personnel. The number is rising to the level of the general population, despite a lower average age. It is higher than during the 1942-45 war years.

Doctor John H. Willard of Philadelphia said it would appear that stresses other than those of combat are important in causing ulcers: separation from family, feeling of frustration and lack of purpose.

"If added to this," he told the American Medical Association, "there is the lure of easy life and a chance of being evacuated stateside, the problem is multiplied."

"BODY PIN" TEST FOR TUBERCULOSIS

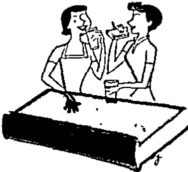
A simple, effective and a method for rapid diagnosis o culosis has been developed, H. J. Corper, professor of University of Colorado.

He told the American

Tuberculosis the test consists of injecting chemicals into a patient's arm. If the patient has the disease, there will be a reaction in about 30 seconds.

MATERNAL FEEDING CLUE TO PREMATURITY

A study of 404 pregnant women showed a greater percentage of premature births occurring among those whose nutrition was poor, report Dr. P. C. Jeans and his associates at the University of Iowa.



The chief nutritional deficiency was calcium. Milk intake was surprisingly low. Many also showed low protein intake.

Doctor Jeans also observed that the lowest birth weights, low vitality and larger numbers of deaths occurred among infants born to the most poorly nourished mothers, he said in the *Journal of the American Dietetic Association.*

GAMMA GLOBULIN CURBS SHINGLES

The painful symptoms of herpes zoster, also known as shingles, have been curbed in five of the first six patients treated with gamma globu- r. I. Irving Weintraub of Gainesville, Fla., said in *The Journal of the American Medical Association.* Gamma globulin previously has been used in the treatment of measles and the liver disease, infectious hepatitis.

Herpes zoster is a virus infection of the nerves. It produces severe pain and scarring blisters of the skin

MISCONCEPTIONS ABOUT EPILEPSY

Archaic misconceptions about epilepsy have existed for hundreds of years, says Dr. Edward D. Schwade of Milwaukee.

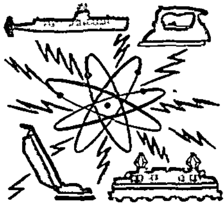
Among the myths are that epileptics are a mental problem, are feebleminded, will deteriorate mentally, have a peculiar personality and that they are dangerous to themselves and to society.

Scientific advance in the field has far exceeded the social reforms and public enlightenment concerning the disease, Dr. Schwade said.

DRUGS CONTROL UNBEARABLE ITCHING

Reserpine and chlorpromazine, two newer drugs that have been used effectively in the treatment of high blood pressure and mental states, are proving valuable in dermatology where patients are frantic from uncontrollable itching.

Doctors Theodore Cornbleet and Sidney Barsky report the patients are more easily able to bear the itching and less frantic about emergency relief. The drugs, however, do not cure the cause of the itching. They just help the patient live with the condition more peacefully.



ELECTRICITY from the ATOM

by Waldemar Kaempffert

Condensed from The New York Times

AT WEST MILTON, N. Y., the General Electric Co. has been experimenting with a prototype of an atomic reactor which is to be installed in the submarine *Seawolf*, sister of the *Nautilus*, now in service. Recently both the reactor and the *Seawolf* played their part in the news. Power from the prototype plant was sold at 3 mills a kilowatt-hour (less than cost) to the Niagara-Mohawk Power Corp., and the *Seawolf* was launched with appropriate ceremonies at Grotor Conn , where the *Nautilus* had been built earlier.

The prototype or experimental duplicate of the *Seawolf's* power plant is within a steel sphere 225 feet in diameter, the largest structure of its kind ever built. It is the function of the sphere to prevent the escape of radioactive material from the reactor, this on the remote chance that many safety devices may fail simultaneously. Every weld of the sphere was radiographed in a search for flaws. This done, the whole sphere was coated with a soapy solution and air pumped in until a pressure of 20 pounds was reached Bubbles of air would appear in the soapy solution if there were any leaks. None was found, though there are five miles of welding

The prototype of the *Seawolf's* power plant is mounted in a section of an actual submarine within the steel sphere. A large tank of water surrounds the reactor and serves as an additional protection against radiation.

Lewis L. Strauss, chairman of the Atomic Energy Commission, threw a switch which sent current generated by the prototype of the *Seawolf's* reactor into the Niagara-Mohawk system. A gigantic lamp glowed on the platform where he stood when the switch was thrown, householders drove their vacuum cleaners
conditioning machinery
this diverted atomic po
papermen wrote accounts
monies on electric ty
by atomically

It was not the first
is called "atomic

utilized for practical purposes, but it was the first time that power from an atomic reactor was pooled with that generated in the ordinary way. Nobody along the Niagara-Mohawk line could tell whether the current that lit a lamp in the living room or froze cubes in the kitchen refrigerator came from an ordinary steam plant or from the prototype of the *Seawolf's* power plant.

Steam from the atomic reactor at West Milton drives a 10,000-kilowatt turbine-generator which could supply a city of 30,000 with the electric power that it needs. The West Milton reactor generates heat, which in turn raises steam for a turbine that drives a duplicate of the *Seawolf's* propulsive machinery. Only the power not required to drive the machinery goes into the Niagara-Mohawk system.

The General Electric Co. does not much care whether or not excess electric power from the West Milton plant is utilized. Nor does the Niagara-Mohawk system care, since the power that it receives is no cheaper than what it can buy and is negligible in amount.

How power is produced in atomic plants is an old story by this time. It is the story of a chain reaction which is started when uranium 235 is bombarded by neutrons. Fragments of split uranium atoms fly about. They collide with one another, with anything in their path. When any projectile is suddenly stopped, some disposition must be made of its energy. The energy is [illegible]rted into heat.

In a reactor so much heat is generated by bits of broken atoms suddenly stopped that it can raise steam to drive a turbine-generator. What we erroneously call "atomic power" is not atomic at all. It is the heat generated by suddenly stopped flying fragments of atoms from which a plant like that at West Milton gets its power.

The application of these principles presents difficulties. The fragments of atoms that fly about are radioactive, and radioactivity is a bane in a nuclear engineer's life. Moreover, the neutrons that do the bombarding contaminate everything they encounter—contaminate it in the sense that they make it radioactive.

In the *Seawolf* molten sodium absorbs heat in the reactor. Then the sodium passes through stainless steel pipes to a heat-exchanger, which is a sort of boiler. The molten sodium heats ordinary water in the heat-exchanger and so raises steam to drive a turbine. Since the molten sodium which goes to the heat-exchanger and which is radioactive does not come into direct contact with the water in the heat-exchanger the risk of contamination is reduced.

In the *Nautilus* water is heated in the reactor to be pumped to the heat-exchanger. Why is sodium used in the *Seawolf?*

The Atomic Energy Commission has long been experimenting with different "coolants," as they are called, that is, with fluids that will absorb heat generated within a reactor. At least a score of coolants have been considered and tested in

this country and in Britain Each has its advantages and disadvantages Efficiency and cost are the principal considerations. Which coolant is the most efficient and most economical in the long run is a question that has not yet been answered definitely. Hence the need of re-experimentation that may take a few more years.

No matter what coolant is used it absorbs neutrons. It is this absorption that bothers engineers most When it absorbs neutrons, as it always will, the coolant becomes radioactive, and the radioactivity increases as the coolant is used Ultimately the coolant must give way to a fresh supply. Sodium absorbs neutrons less readily than does water It is for this reason that the Atomic Energy Commission decided to subject it to a full-scale test in the power plant of the *Seawolf*.

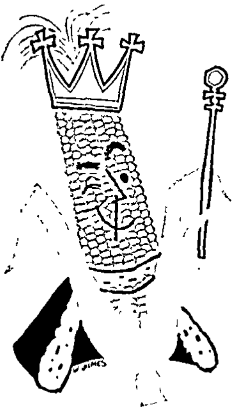
Sodium, a better conductor than water, transfers its heat more readily than does water in the process of raising steam in a heat-exchanger. This is another point in sodium's favor. Besides, water corrodes steel. Sodium is far less corrosive at the temperatures that prevail in an atomic power system. When stainles steel is used the problem of corrosion almost ceases to be important with sodium Lastly there is the ease with which sodium can be forced through pipes by pumps that have no moving parts — something that cannot be done with water. All these advantages are evaluated in the selection of a coolant, but the one that outweighs all others is the relatively low absorption of neutrons by molten sodium

The Atomic Energy Commission is still making comparative experiments with different types of reactors Hence the two different types designed for the *Nautilus* and the *Seawolf*. Each type has its advocates, and each its merits and demerits

Much will depend on the comparative performances of the *Nautilus* and the *Seawolf;* for it is not yet clear which type of reactor will be better for a surface commercial ship. If, as planned, we build six more submarines to be propelled by atomic power, a comparison of the *Nautilus* and the *Seawolf* will teach much.

The cost of the *Nautilus* is said to have been $57,200,000 In the address that he delivered on June 14, 1952, when her keel was laid, President Truman said that without her power plant she would cost about $30,000,000 This leaves $27,200,000 for the power plant, including the cost of research. The cost of the *Seawolf* will be about the same.

THE IDEA that mushrooms, mildews, rusts and other little need for light is contradicted by U S. Department culture experimenters. Many fungi, experiments show, to start spore formation, the method by which fungi asexually, and although the fungi may not use sunlight their life processes are accelerated or inhibited by l



Why Corn Is King

by Robert Froman

Condensed from Collier's

AMERICA'S NUMBER ONE farm crop — namely, corn — is taking on countless new and mysterious forms totally unrecognizable to those of us who think of it only as what we nibble off the cob or as a label for ancient gags.

If you look around you right now, you'll probably see at least a dozen items made of or with corn products, some fresh out of the laboratories, some a hundred years or more old. In fact, if you're looking through spectacles made with safety glass, there's corn in them. There's corn starch in the page before you (I said corn *starch*). There's corn-starch sizing in the fabric that covers the chair you sit on.

The paint on your walls and the stockings on your wife, the leather of your shoes and the polish on the leather, the tires on your car and the castings of its engine, the insulation of your refrigerator and much of its contents — all may contain one or more of the products turned out by the nation's corn refiners.

Even if you're one of those people who can't digest corn on the cob and don't like bourbon whisky, don't imagine that your diet is corn-free unless you also avoid all meat, dairy and poultry products. Corn provides the major part of the feed given all U.S. livestock.

More than any other crop, corn is man's handiwork. Botanists aren't sure how corn originated, though they've found a few types of South American wild grasses which may have been its ancestors. They estimate that it took several thousand years of cultivation by the ancient Incas, Aztecs and others to produce

Collier's (May 31, '55), 640 Fifth Ave., New York 19, N. Y. Copyright 1955 by The Crowell-Publishing Co

the plant as it is known to us today.

Taking up where the Aztecs left off, modern farmers and scientists have developed thousands of corn varieties suitable for growing in every part of the world from the sub-arctic to the Equator, from semi-desert to swamp. But of the world's total production of more than 5,500,000,000 bushels, the U S still grows well over half

One reason for America's dominance is the ideal soil and climate for the crop in the Corn Belt, stretching from Ohio to Nebraska and from Missouri to Minnesota. Another is the development of sensationally productive hybrid-corn seed by U.S. researchers.

Since the early 1930's, when the new-type seed began coming into use, farmers have been producing ever bigger crops from constantly shrinking acreages In 1930 they had to plant about 104,000,000 acres to get 2,000,000,000 bushels of corn. In 1954 they grew nearly 3,000,000,000 bushels on only 82,000,000 acres. The hybrids are so prolific that an average acre will yield more than twice as much corn as wheat from less than one-eighth as much seed

About 85 percent of the total U.S. crop goes directly to livestock as feed, and another 7 percent or so goes to processors who turn it into special types of feed So-called dry millers grind some 70 million bushels a year into corn meal, hominy, corn flour, grits (including about 14 million bushels a year for beer brewers) and other foods. Breakfast-cereal makers process 11 million bushels a year, and we eat another few million bushels unprocessed, in the form of sweet corn and popcorn.

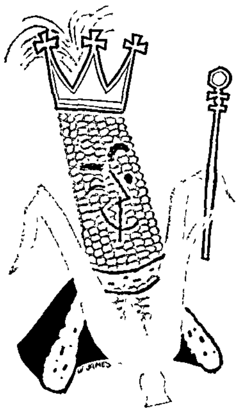
Twenty to 30 million bushels a year go to distillers, who turn it into industrial alcohol, gin and that uniquely American potable, bourbon. In fact, two thirds of the grain that goes into our distilled spirits is corn. (Though rye lingers as a generic term for blended whisky it accounts for only one-sixth of the total.)

Some 130 million bushels are taken by the wet millers or corn refiners, and this portion, although less

mail-order catalog.

"My old daddy," a chemist at one corn refinery told me, "used to say, 'Son, never be a jack-of-all-trades. There's no future in it. Specialize, son, specialize.' I wonder what he'd say if he could see me now. In the last couple of years I've worked with steel-company technicians, a candy-maker, an oil driller and a printer, to name just a few. They all wanted—and got—special new corn products to solve complicated production problems.

". . . Why, I've even had to take a short course in surgery. A pharmaceutical company got me involved in that. To make rubber gloves slip on easily, surgeons once dusted the inside of them with talc. But in the middle of an operation a glove worn by one of the doctors had split open and a few grains of the talc had spilled into an incision he had made



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Some 130 million bushels are taken by the wet millers or corn refiners, and this portion, although less than 5 percent of the total crop, goes into an ever-widening range of products A list of them would read like a mail-order catalog.

"My old daddy," a chemist at one corn refinery told me, "used to say, 'Son, never be a jack-of-all-trades There's no future in it. Specialize, son, specialize ' I wonder what he'd say if he could see me now. In the last couple of years I've worked with steel-company technicians, a candy-maker, an oil driller and a printer, to name just a few. They all wanted—and got—special new corn products to solve complicated production problems

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in the patient. Since the talc was inorganic, the patient's tissues couldn't absorb it, and the doctors had a devil of a time clearing up the resultant adhesions.

"The pharmaceutical company figured there ought to be some sort of starch that would do the dusting job without being a potential danger to the patient. To find out exactly what the company wanted I had to learn the whole operating procedure in detail. Turned out that we needed a starch which, among other things, could be steam-sterilized without getting sticky. That was quite an order, but we finally worked it out and I hear the result was exactly what the doctors ordered.

"I'm specially proud of that job. You see, starch has always been used as an adhesive or an ingredient of adhesives. In this product, the purpose is just the opposite—to make gloves slip on and off easily. Gives you an idea of how versatile starch can be."

Although it can be extracted from many vegetable crops, starch in the U.S. today usually means corn starch because the grain readily yields large amounts in a quite pure form. About 15 percent of a kernel of corn is water. Four fifths of the rest is carbohydrate, most of which is starch. The other fifth is made up of assorted proteins and oil.

Corn refiners are called wet millers because to separate the starch and other ingredients they first steep the kernels in warm water for a couple of days. This process loosens the hulls and the corn germs. Then, when the kernels are crushed, the light, oily germs float away, the hulls can be screened off and the heavy gluten, which contains the protein, can be whirled to one side in a centrifugal separator. All are of value, but the main product of a corn refinery is the white starch, which remains after the other parts have been removed.

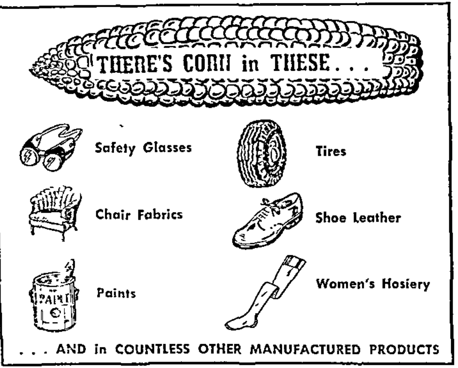
Starch has infinite uses. Highly digestible and an excellent thickener, it goes into food products ranging from soups to desserts at the rate of 500 million pounds a year.

It goes into sizing (a toughening and strengthening agent) and coating for paper at the rate of 450 million pounds a year, and into sizing for textiles at 300 million pounds a year.

It paradoxically "lubricates"—that is, keeps free flowing—the muds used in drilling for oil, and holds together the molds in which castings ranging from gumdrops to locomotive parts are shaped.

But starch is even more useful as a starting-point for a wide range of other products According to a favorite legend of the corn refiners, one of the most important of these products was discovered by accident. Many years ago, they say, the overflowing warehouse of a corn-starch maker burned to the ground.

The owner put laborers to work cleaning up the mess. But the scorched starch had become *so sticky* that shoveling it was nearly impossible. One of the owner's products was a starch used as an adhesive. If scorched starch was so much stickier



than unscorched, he reasoned, maybe there was a market for it too.

There was. The starch maker had stumbled on something far more valuable than his lost warehouse. Today, U.S. corn refiners roast starch in enormous cookers at a rate of nearly 200 million pounds a year The roasting turns the starch into dextrins—of which there now are scores of varieties—for use in binding together everything from prefabricated house parts to paper bags.

I asked one dextrin expert, Dr. T. A. White of National Starch Products, Inc., why there are so many kinds of dextrins. "They all meet different needs," he explained. "The adhesive on the flap of an envelope is a dextrin The package containing your favorite breakfast food may be sealed with a dextrin-type adhesive. A dextrin may be providing the crisp finish on your wife's organdy dress—or holding the cork tip on the end of your cigarette. I could go on indefinitely."

Another class of *corn-starch products* is made by mixing starch with water and hydrochloric acid, then cooking it. If only a minute quantity of the acid is used, the result is corn sirup—of which you probably eat about nine pounds a year (the national per capita average), m tly in the forms of candy and sirup, but also in hundred baked, frozen and canned f

may be wearing it on your shoes, too, in the form of polish, or on your back, since it's an ingredient of rayon.

If the acid solution is slightly stronger—approximately its natural strength in your stomach, where it is an essential part of your digestive juices—the result is corn sugar and, eventually, dextrose. Dextrose is identical with the sugars in your blood. At this moment someone's life probably is being saved by an intravenous injection of dextrose to help him recover from the shock of an operation or an accident.

Intravenous injections represent only a minor use of dextrose, however. We consume nearly 800 million pounds a year in foods, soft drinks and various flavorings. From it also come sorbitol, used as a moisture-conditioning agent in foods, confections and cosmetics, and mannitol, which makes caps for setting off explosives and serves as a base for pharmaceutical preparations.

From the corn germs, each about a 15th part of a kernel, the refiners press over 200 million pounds of oil every year, for use principally in cooking oils, salad oil and margarine. Smaller amounts are used in the manufacture of soap, leather tanners, ammunition and paint. And lecithin, a by-product of the oil-refining process, is used to emulsify ingredients of everything from drugs and cosmetics to motor oils and linoleum.

The rest of the kernel, consisting mostly of gluten (a protein) and cellulose, were once thrown away as [illegible]less. Legend has it that an upstate New York corn refiner dumped so much gluten into the Erie Canal in the 1880's that he caused a small flood which spread over a number of dairy farms. There the cows were said to have lapped up the mixture and started producing record-breaking flows of milk. Whether or not the story is true, gluten feeds for cattle became an important corn by-product about that time.

In the 1930's chemists discovered that the proteins contained in gluten could compete even with starch in versatility. Currently, the most important of these proteins is zein (pronounced *zeen*).

Small amounts of zein go into printing inks, hair lacquers and rug backing. But its chief use is in Vicara, a wool-like synthetic fiber for suits, coats, sweaters, women's hats, shoes, handbags and other textile products.

Now the chemists are working on other corn derivatives, such as leucine, tyrosine and methionine, and there's no telling what they may come up with.

In recent years even the steep-water used to soak the kernels in preparation for wet milling has been put to work. The U.S. and British governments put researchers to work in 1943 on the problem of mass-producing penicillin, then available only in tantalizing driblets. At the Department of Agriculture's Northern Regional Research Laboratory, in Peoria, Ill., a biologist dumped a jug of corn steep-water into a mold culture. That culture produced ten times more penicillin than before.

Since then penicillin and most of the other antibiotic-producing molds have been fed on steep-water. Now, however, some drug firms are testing other nutriments which may prove even more effective. If they do, it will be no tragedy for the corn refiners Their eyes opened by the Peoria discovery, they've looked long and hard at their steep-water and have found it full of other potentials

One already realized is inositol, a member of the B-complex vitamin group for which steep-water has proved the first commercially feasible source. Currently under investigation for use in treatment of diseases of the heart and arteries, inositol may make steep-water one of the most important refining products.

Impressed by the ingenuity with which the refiners make use of the tiniest fractions of the corn kernel, I asked Dr. C F Speh, a Department of Agriculture research expert in Washington, about utilization of other parts of the corn plant.

"Guess people have been trying to do something profitable with them for several thousand years," he told me. "Actually you can make fine fuel, fertilizer, cork substitute and lots of other things from the cobs, good paper and wallboard from the stalks and leaves, and vitamin products from the tassels Trouble is, you're up against tough competition —competition from livestock. They turn the cobs, stalks, leaves and tassels into ham, bacon, roasts and chops — and they'll go out in the cornfield and collect the stuff themselves if you want them to. It's cheaper to leave the waste matter for the livestock than to collect it for other uses."

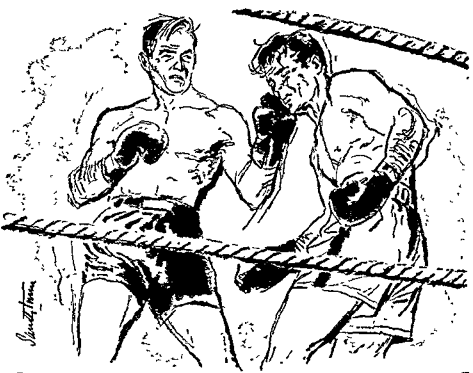
Time and again, he explained, rumors have started that someone has found a use for cobs that will make them worth as much to the farmer as the corn itself So far, about the only farmers who've collected cash for their cobs are those who grow a large, solid variety for pipe makers.

The Quaker Oats Co takes half a million tons of cobs a year to make furfural (a chemical used in nylon and numerous other synthetics), but it buys them from truckers who get them for nothing from farmers who don't keep livestock and therefore are glad to be rid of the cobs.

A few other processors gather cobs in the same way but on a much smaller scale, for use chiefly in soft-grit blasting of metals and in packing and insulating materials

Since the stalks and other parts are not delivered to shelling stations, anyone wanting them must collect them from the fields, an expensive undertaking Only in a few corn-growing areas where livestock aren't raised are enough of these materials available for a few small-scale paper and wallboard operations.

"There's plenty in the kernel to keep us busy, anyway," Robert G. Ruark, vice-president of C
ucts Refining Co., New Y
"In a few years what we'
plished so far will seem el



Can Boxing Be Made Safe?

by Georg Mann

A SMASHING right hand high on the head did it in the fourth round, although the bout was far from over. Contreras dropped as though he had been axed. Yet in the fifth, he fought back gamely, took the round. From there on, the end was inevitable. Bolton drove his opponent around the ring, hit him almost at will. Middleweight José Contreras seemed unable to defend himself. At long last, in the eighth, the referee stopped the fight, declared a TKO (technical knockout).

Contreras, aged 29, walked unaided from the ring. But in the dressing room he suddenly collapsed. At the hospital to which he was sped, a surgical team worked for hours trying to remove the blood clot they found in the left side of his brain.

When they wheeled him back to his room, the best the doctors could say was that he still lived. The next day Contreras rallied, just as he had

[illegible]

daughter, his 12-year-old son. The doctors' gloom lightened to a cautious optimism. Then Contreras

lapsed back into a coma, died a week later on May 9, 1955.

Just one of those things? Sure, just one of those things, a routine ring killing—except when ring killings get routine, somebody ought to try to stop them. What will happen? Probably nothing There was talk of holding hearings on why the referee let the fight go on after Contreras seemed unable to defend himself.

The real culprit was the boxing business itself — and the fans who aren't happy unless somebody is being clobbered toward oblivion. Add up the figures, and boxing looms large as a killer and a brainwasher whose victims can never be educated back to sense

Since 1900 more than 300 men have died from injuries incurred in the ring. Nobody has counted the numbers of those who "died" months and years before they were buried.

Amateur boxing also has had its share of casualties In the United States since 1949, collegians at the Colorado School of Mines, the University of Arizona, and the University of Michigan have died in spite of all the safeguards that surround the amateur sport One of the fatal bouts was fought with 14-ounce gloves, disdainfully regarded as mere feather pillows by the pros.

Is the death list declining? Not as fast as the number of boxers in the professional sport. Since television, many local fight clubs have gone out of business. The list of deaths varies from year to year, sometimes more, sometimes a little less than a dozen fatalities.

What's being done about it? One answer is found in an article by Dr Frank Ferlaino in *The Journal of the American Medical Association.* Ferlaino has been an active figure in trying to make boxing safer, but he writes, "Experience has shown that after each death in the ring, promises are made to institute measures to prevent recurrences, but usually these promises are soon forgotten" Sharply, he adds, "Boxing authorities have justified their lack of interest in medical and safety programs by claiming that such programs hurt boxing and that deaths occur in all sports. . The mortality rate among boxers can and should be reduced."

Ferlaino's ideas about what ought to be done make sense. He wants research aimed at making a boxer's gloves less perfectly designed to protect his hands, and far better designed to protect his opponent's brain

The ring needs a thicker padding to protect the fighters who go down on the back of their skulls.

The mouthpiece has helped cut down damage to the mouth and teeth Now what is needed is a more resilient mouthpiece that can cushion the brain against the hemorrhage-causing shock waves that travel from the jaw to the brain.

Medical examinations of boxers before a bout have been improved in New York and some other states. They could be still more thorough

One concrete improvement of medical examination techniques w[illegible] made by the University of C[illegible] nati a couple of years ago.

on the very surface of the brain."

The effects of such hemorrhages, far less dramatic than those which killed Contreras, are in the end just as drastic, even though they may take years to reveal themselves. For there is one solemn medical fact about boxing. Damage to the brain, through hemorrhage or otherwise, is irreversible. Unlike other parts of the body, the brain can't repair itself. When part of the brain is damaged, that part's gone forever.

When do these changes start? It varies among boxers: the worse the boxer, the sooner the change. Twenty-odd years ago, Dr. Edward J. Carroll figured that a boxer begins to soften up somewhere in between his 30th and his 60th bout—unless he is a master of his craft.

He gets easier to knock out, his timing goes, his defensive ability collapses before his ability to dish it out. At the end of a round as he returns to his corner his feet drag noticeably.

Outside the ring, he can't concentrate on conversation, his mind begins to wander. His eyes become fixed and glassy. Finally, as area after area of the brain dies, the boxer's speech begins to blur and there are involuntary body movements—watching a fight the punch-drunk boxer punches away from his seat.

Summing up, Dr. Carroll said, "It is probable that no head blow is taken with impunity, and that any knockout, from whatever cause, results in irreparable brain damage."

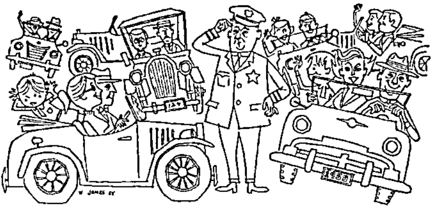
In Denver, where the Boxing Com- [illegible]ion has decided that all boxers ought to have brain-wave tests at least once a year, Dr. Ewald W. Busse and Dr. Albert J. Silverman ran a series of tests on Colorado boxers. Tests on 24 boxers showed that 4 had patterns showing severe disturbances, 5 had moderate disturbances, and 15 were normal.

Of the 24 boxers tested, 10 had been knocked out at least once Of these 10, 3 had severely abnormal patterns, 1 had a moderately abnormal pattern. Of the 14 who had never been knocked out, only 1 had severe brain-wave changes, 4 showed moderately disturbed patterns.

Is there any solution? One comes from Dr. Arthur Steinhaus, professor of physiology at George Williams College in Chicago. He simply wants two foul-zones in boxing instead of the present one zone below the waist. One foul-zone would be located below the waist, the other above the neck.

Blows below the belt, while painful and disabling, have largely been circumvented by modern technology. Furthermore, as all results indicate, any damage can be readily repaired by surgery. A ruptured spleen, a fairly common cause of football fatality, is almost unkown in boxing. Furthermore, abdominal muscles can be thickened and toughened by training. But the boxer can't do a thing to improve his skull bones.

Making boxing safe—perhaps by adopting Steinhaus's suggestion—would make sure that some of our stronger, tougher, and more fearless athletes will not wind up with scrambled brains, or as just another case on a table in the morgue.



OUR TERRIBLE TRAFFIC

Condensed from The Wall Street Journal

THEY'VE CALLED OUT the National Guard in Michigan—to help control traffic.

Helmeted soldiers with rifles now patrol major intersections on big holiday weekends to aid state highway police in keeping the hordes of Sunday drivers in line. Fifteen Guard planes fly overhead on reconnaissance for traffic jams

In Los Angeles, the police department is looking for big helicopters. They want them sturdy enough to lift wrecked cars from the sprawling city's five major freeways One morning three wrecks within a half hour blocked off the heavy going-to-work throng of motorists as effectively as a picket line Hundreds of idling motors became overheated and stalled By the time the mess was cleared up, a good many Angelenos were over an hour and a half late to their jobs.

Lafayette, Ind., went to a lot of expense in 1937 to build a bypass around town to get traffic off the main streets. Now it is faced with the chore of building a bypass around the bypass.

Things are so congested in Brooklyn and Queens that Park Commissioner Robert Moses is thinking of installing parking meters along the winding lanes of the two boroughs' parks.

These desperate measures are symptomatic of the woes piling up for cities, large and small, as a result of the fantastic buildup in the number of cars on the streets since the end of World War II. Millions of dollars of local bond issues are being sold for new expressways and parking garages. There are more traffic cops—and they are getting tougher, too New electronic stop-l'gh ets, radar and television pressed into service All,

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The Wall Street Journal (June 21 '55) 44 Broad St, New York N Y

still running second best to the growing congestion on the streets.

Ultimately, a few authorities believe, jampacked traffic may even start putting a brake on the auto industry itself, whose $10-billion-a-year volume is a major prop under the nation's current prosperous economy. The huge oil and steel industries, and hundreds of other businesses that depend on automobiles, would be affected, too.

By December, more than 60 million vehicles will be on the road, compared with 31 million just ten years ago. At least 6 million new automobiles and more than a million trucks will pour out of auto factories this year to add to the congestion. And, based on experience in recent years, only 3 million to 4 million old jalopies will be junked in 1955. Already at the start of this year, 58,-589,863 registered vehicles were enough to form a bumper-to-bumper string of cars 200,000 miles long.

Projections for the future aren't too encouraging, either. By 1965, the Automobile Manufacturers Association estimates, registrations will reach 81 million. Annual vehicle mileage, which has soared from 249 billion to 557 billion in the last ten years, is slated to go to 814 billion miles by 1965, these experts figure.

Their guesses may be on the low side. A few years ago Michigan estimated its traffic would hit 26 billion miles in 1965. The state exceeded that in 1953 and now is racing along at a 30 billion-mile-a-year clip.

"Present roads just can't handle it," a spokesman for the Michigan Highway Police announced recently.

"Every major facility I know of, here or elsewhere, which was projected 15 or 20 years ahead, proved inadequate almost from the day it was opened to traffic," Timothy J. O'Connor, chief traffic engineer for Boston's Traffic Commission, comments.

The Hollywood Freeway in Los Angeles, opened last year, was designed to handle 100,000 cars a day; already the load has hit 168,000. "We never believed it would get so crowded," says Deputy Chief Harold W. Sullivan of the Los Angeles Police Department. "Traffic is so heavy on the Hollywood, Santa Ana and Harbor Freeways that the least mishap jams them up for hours."

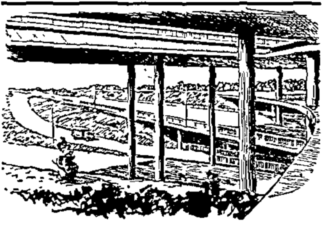
Resurfacing of Chicago's lakefront Outer Drive, which has averaged over 100,000 cars a day for years, recently caused morning and evening traffic jams 40 to 50 blocks long.

The huge San Francisco-Oakland Bay Bridge is six lanes wide, but that's no help. Jams eight miles long, extending along U.S. 50 into the center of Oakland, have been measured this year.

"Brutal" is the expression Pittsburghers use for the fender-rattling ordeal of driving into the "Golden Triangle." Every day 80,000 automobiles, 2,300 streetcars, 2,200 buses and 16,000 trucks pour into the narrow three-lane irregular streets of this downtown section, only 9/10ths of a square mile in area.

St. Louis, more spread out, now has 400,000 vehicles on its streets each day, Monday through Friday

according to the police department. "That's doubled since 1945," an official says, adding that if the federal government ever follows through with its new plans to make a national park out of the city's Mississippi River waterfront, now used as a 4,000-car municipal parking lot, "we'll be in a hell of a fix."



FOUR TRAFFIC LEVELS help straighten out Los Angeles traffic. Top and third decks are for freeways. Second and bottom decks are designed for area's local traffic.

Folks who escaped to the suburbs find they didn't get away from the traffic problem after all At Mineola, Long Island, the number of cars converging on the Long Island Railroad's commuter station has gone up 75 percent since 1946, overflowing the station's 150-car lot and ebbing out into neighboring streets almost a mile from the station. "If we had

most of its suburban station parking lots and "we could use additional space at almost every station," Joseph A. Fisher, president, says.

Even on the open highway, congestion is causing troubles. "Our two-lane roads can take 5,000 cars a day comfortably and safely, but we have them carrying 10,000, 12,000

"Traffic around our station is jammed during the morning rush hour," admits Mayor Thomas F. J. Quigley of Stamford, Conn A group of lots, holding 520 cars, is not enough for the 2,700 commuters who take the train to New York every day, and Mayor Quigley is appealing to the railroad to build a new 1,500-car parking garage.

The Reading Railroad, operating commuter service to Philadelphia, has doubled or trebled ... y of

lion) and more miles of high-speed expressways than any other state, has long been the favorite butt of comedians for "accident" jokes But they're not funny to Governor Goodwin J Knight. "It is plainly evident that vigorous action must be taken to stem the swelling tide ... deaths and injuries," he

His remarks were pr... a report which showed persons died on Calif...

during the first five months of 1955. One of history's great catastrophes, the San Francisco earthquake and fire, took 542 lives. There is nearly one traffic accident a minute in the state and the number of crashes in which someone is killed or injured soared from 74,000 in 1946 to 108,000 last year.

Growing congestion and increasing accidents are "pretty much cause and effect," according to Clayton Hess, safety education director of California's State Highway Patrol.

Another governor is seriously concerned. In congested New Jersey, daily traffic flow on the highways averages 11,000 vehicles per mile, 7½ times the national average.

"Such facts can no longer be dismissed as symptoms," Governor Robert B. Meyner told the state legislature this year. "They must be realized for what they are—the hardening of the arteries of transportation. Today vast urban areas within the state suffer from traffic strangulation. Central busines districts find it increasingly difficult to attract customers and industry faces a more restricted labor pool each year because of inadequate highways."

Some views differ, however. Henry D. Shenk, of the Pennsylvania Turnpike Commission, says: "Congestion usually makes for fewer accidents because people drive more carefully in crowds".

Tabulations of the National Saf [illegible] 38,300 and 1,350,000 in 1953 de- [illegible]e 2,500,000 more cars on the road last year, would tend to confirm this. But this year the trend has turned upward again

Getting in and out of a big city on a holiday week end calls for icy nerves and a steady hand. Traffic on the George Washington Bridge, from New York City to New Jersey, soars from its daily average of 85,000 cars to as high as 134,000 and jams have developed on Route 17, the feeder line, as far as Monticello, N. Y., 84 miles from the bridge. C. McKim Norton, vice-president of New York City's Regional Plan Association, predicts that by 1970 it will take an overnight trip to reach the open countryside.

Congestion is adding millions of dollars to motorists' tire and gasoline bills. Using a 1953 Chevrolet, a stop-watch and a burette (a tiny syringe for measuring gas), traffic engineers for the Chicago Motor Club conducted time trials over expressways and typical non-Loop city streets.

On one stretch, it took the drivers 20 minutes, including 10 stops, to cover 5 miles. Average speed was 15 miles per hour, and gas consumption was 15.6 miles per gallon. The same car navigated 5.5 miles of the expressway in 6½ minutes for an average speed of 50½ mph on still less gas—averaging 17.8 miles a gallon.

Expressway projects are being embraced by more and more cities as a partial solution to traffic troubles. These limited access, non-stop speedways cut both time and the accident rate, their adherents say.

But it's a costly business. Detroit

plans to spend $800 million for 115 miles of expressways and Chicago is speeding the timetable for a $600-million, 90-mile system to 3 years from the 10 to 15 originally planned. Pittsburgh is spending $58 million for new expressways. A $750-million highway bond referendum goes before New York voters in November Massachusetts plans to spend between $500 million and $750 million in the next five years.

Other cities, like Salt Lake City, Tulsa and Rock Island, Ill., are staging "ride the bus weeks" and "months" in an effort to reconvert motorists into straphangers.

The drawback to these efforts, of course, is that a man in a car can still beat a man in a bus The Chicago Transit Authority has spent more than $90 million for new, faster equipment since the war, yet its buses still crawl through the Loop during rush hours at 3- to 4-mph, horse-car speeds. Partly as a result, patronage on the buses and street cars has fallen 46 percent since 1946

The American Society of Planning Officials reports that dozens of cities and states are now conducting surveys in search of a cure for this mass-transportation dilemma More than a thousand Milwaukee citizens have been interviewed to find out why they don't use mass-transit vehicles. An $800,000 study of rail commuter difficulties is now being made in the New York-New Jersey metropolitan area

And on a smaller scale the same thing is going on in such places as Wilkes-Barre, Pa., Akron and Cuyahoga Falls, Ohio.

Car of Future Will Take to Sky

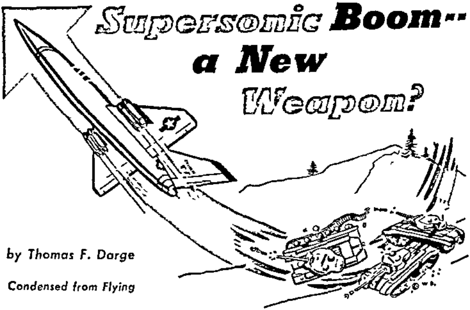
The automobile of the future must eventually take to the sky, according to Hugo Gernsback, editor and publisher of *Radio-Electronics* magazine

Gernsback believes that a radical change in the design of present-day cars is the only answer to the growing problem of congestion He feels that a thin 2-wheel gyro car will alleviate the problem at least temporarily. Such a car he points out will give us over 40 percent more space in the streets and roads.

He also anticipates the development of safety devices in cars calculated to cut down the horrible accident toll Radar brakes and a pitch-fork-shaped "Scoop-stop" to cut down crash injuries will be incorporated in the car of the future, he feels

But, he says, eventually cars must take to the air The family "airmobile" will be able to counteract gravity and take off right from the street Directly powered by atom-electrical energy the car will rise up and cruise in specified airlanes But it will be able to travel in the conventional manner on the ground as well—with one exception There will be no waiting at red lights
mobile will be able to hop
intersecting traffic

Supersonic Boom — a New Weapon?



by Thomas F. Dorge

Condensed from Flying

THERE IS a potential new weapon in our aerial arsenal. It requires no manufacturing process; it need not be stockpiled for future use, or distributed to combat squadrons in time of war.

In the planes, the device in itself occupies no space and weighs nothing—yet it can come into play whenever the pilot opens wide the throttles or turns on the afterburners.

Its effects are startling, even to military observers whose vocabulary has been enriched in recent years by such terms as "tactical A-bomb," "megaton" (a million tons), and "megadeath" (a million deaths). Whereas nuclear bombs are designed for *area* annihilation, this weapon inflicts *linear* damage; it affects "soft-skinned" targets within a strip only a few hundred feet in width, but is several hundred miles long.

Its name? The supersonic shock wave, alias, The Sonic Boom, or Bang.

Shock waves surround any object traveling at or above the speed of sound. They account for the ominous "ripples" first noted by World War II fighter pilots when they glanced at the wings of their planes during a power dive. Again, shock waves hurtling against wings and control surfaces brought many attractive protoypes and their pilots to a tragic end at the dawn of the supersonic age.

The introduction of thin, swept-back wings, "all flying" tail surface, and a much greater safety factor in the structure of modern planes has now taken the teeth out of the shock-wave effect — for the planes themselves.

However, as far back as 1949, a

Flying (July '55), 366 Madison Ave., New York 17, N. Y.

worried citizen around Wright Field phoned the local police headquarters to report "explosions in the sky." These, it was later revealed, were the F-86 prototypes engaged in supersonic dives at high altitude. The Farnborough Air Show in England, in 1951, was highlighted by a number of supersonic booms which caused great speculation among spectators. Again, shock waves from supersonic flights were responsible.

In attempting to explain the phenomenon, some interesting, if erroneous, theories were produced. The most original one asserted that the sonic boom was simply the aircraft's own noise effects — turbine howl, wind noise, etc.—"stored up" during flight at Mach 1, the speed of sound.

A letter to a British aircraft magazine argued that a stationary object making a continuous noise could be visualized as a focal point from which concentric circles keep emerging, as from a stone tossed in a pond. If the object is accelerated to Mach 1, the argument went on, these circles would become concordant with the moving object, resulting in a single clap of sound to a stationary observer. It was stated that, if an aircraft could manage to fly exactly at the speed of sound for about an hour, the sound thus accumulated would presumably blow the hapless observer off the face of the earth.

Actually, supersonic bangs result from air molecules compressed into the shock waves by the airplane's passage. Below the speed of sound, the airplane is preceded by an envelope of air "warning" these molecules to move out of the way. No such advance notice takes place at or above the speed of sound, and the plane acts like a battering-ram instead of easing into a yielding, "willing," mass of air. The compression thus achieved results in shock waves, trailing like infinitely expanding cones from the fuselage, wings and other protuberances.

The British observer was right on one count, however. The supersonic boom can be forged into a weapon.

The Germans were first to utilize its destructive potential When their V-2's were dealing out random destruction during the closing days of the European conflict, it was noted that the V-2's radius of damage exceeded that of its predecessor, the Flying Bomb. This was most peculiar, since both weapons carried identical loads.

Moreover, in spite of high-speed impact fuses, V-2's augering in at some 2,500 mph — over Mach 3 — usually found time to bury themselves before the warhead went off This should and did result in less immediate blast than the V-1's which went off at ground level.

At the same time, Londoners wondered among themselves about a "double boom" effect. First there would be the detonation of the V-2 warhead; seconds afterwards, a secondary explosion would follow on its heels. We know the answer now. In the laconic words of an expert uttered this past February, "
double explosion of Hitler's
was a sonic bang . . . a g
the resultant destructio

less caused by the big shock wave."

For a more recent, closer-to-home demonstration of supersonic pounding, you may recall the first public demonstration of the F-100 Supersabre at Palmdale, almost two years ago. It featured a low-altitude pass at Mach 1 plus. Unintentional results were shattered window and door frames, large cracks in the walls of airport buildings, window panes blown in with such violence that slivers of glass buried themselves in plaster walls.

The Palmdale damage was caused by an aircraft of relatively small frontal area, flying just above the speed of sound. Moreover, it made its thundering pass several hundred feet above the deck and did not fly directly over the damaged buildings. Even so, the unexpected side effects so impressed military and civilian observers that new regulations were immediately issued to flight personnel. No more supersonic flight below 10,000 feet or over inhabited areas; airliners must be given a 5,000-foot-wide berth.

The supersonic thunderclap may first come into its own as a weapon when the new Convair B-58 four-jet bomber enters squadron service. Appropriately nicknamed the "Hustler," this huge, delta-wing job is said to be our first bomber capable of level supersonic flight. Next to the massive shock wave generated by this behemoth, the single-engined Supersabre's pales into insignificance.

Shock waves, like the wakes of ships, increase in violence with the frontal area of the plane or missi which generates them. At their wi est point, the V-2's were only abo 3 feet in diameter; the fuselage the F-100 is about 7 feet high by feet wide. While its exact dimen sions are, of course a well-kept secret, the B-58's fuselage dimensions should approximate the B-47 Stratojet's, with wings and tail surfaces to match. To this must be added the shock cones slamming down from the massive 15,000-pound-thrust turbines hung in pods under each wing

Picture the drastic by-products of a roof-level buzzing by the bat-shaped Hustler. It could cut a swath of destruction extending some 200 to 400 feet on either side of its path. Directly underneath, the shock wave would exercise a sudden jolting pressure of some 75 pounds per square foot — equivalent to an instantaneous 180-mph hurricane.

This kind of blast would be sufficient to smash unprotected brick structures, destroy or damage unarmored vehicles, and capsize vessels at anchor in port. Further out, forests would be leveled, crops uprooted, herds dispersed and nature herself thrown into confusion.

Naturally the advent of the hydrogen bomb makes these results seem puny compared to a 15-mile radius of total annihilation. However, it must be remembered that this narrow but devastating path could be extended for as many miles within enemy territory as fuel permits; that it could be curved along traffic arteries which bombs can only interrupt; and that the supersonic

boom would probably become a routine side-effect of any future air raid.

It is also likely that there will always be targets too small to warrant expenditure of even a tactical A-bomb; here's where the supersonic "jet boomer" will come into its own. The effect of a shock-wave raid on an arctic airbase, leaving personnel exposed to sub-zero temperatures, could be quite paralyzing; and when H-bomb and A-bomb raids are followed up by this kind of supersonic strafing, it could in itself become a panic weapon of the first order.

The current drive for an enlarged Ground Observer Corps stems from the need to track enemy raiders sneaking through or under our radar curtain. A supersonic buzz job might smash this link in our defenses without firing a shot. Shock waves cannot touch armored or underground installations, but they can wipe out observation towers in the open country. All along the flight path of the intruder, telephone and power lines would be severed.

Shock waves will not, on the other hand, play a substantial part in air-to-air combat. Modern combat planes, built to drive through the sound barrier, are rugged enough to shrug off the wakes left by the passage of other jets. An F-100 recently shot past an F-86 far above the speed of sound, and the pilot of the "slow" 670-mph Sabre didn't even feel a bump.

In peacetime, supersonic flying and supersonic bangs will present few dangers. Military regulations will protect city inhabitants, air-show spectators, and airline passengers It is not even foreseeable when we shall have supersonic airliners, due to the fantastic amounts of fuel required; but we can rest assured that when they come, they will never hit their full "cruising" speed until they've climbed to their most efficient ceiling—some 12 miles up.

"Spider" Spots Meteors

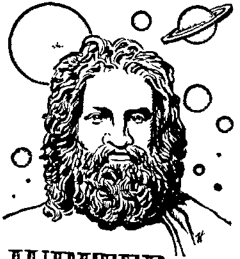
On a Stanford campus hilltop, a spider-like radar device 50 feet across is weaving a radio net across the skies to "trap" tiny meteors and thereby collect new information about radio communications, weather, and the solar system in general.

Nicknamed the "Spider," it is operated by Dr. Von R. Eshleman and Thomas V. Harroun of Stanford's Radio Propagation Laboratory.

Laboratory scientists designed and built it to study the smallest meteors detectable by radar — primarily those midway in size between grains of sand and specks of dust.

Importance of these "stardust" particles from outer space was demonstrated in earlier Stanford investigations Long-distance radio signals can be bounced off the meteor trails.

By beaming signals upward in six different directions from its "corner reflector" antennas, the Spider ca tect and chart the paths of meteo any sector of the sky. Its s are automatically recorded sensitized paper



JUPITER . . . Giant of the Solar System

by *Patrick Moore*

Condensed from a chapter of the book, A Guide to the Planets

NEARLY 500 million miles from the sun, circles mighty Jupiter, giant of the solar system. The ancients named it after the King of the Gods, and the name is indeed appropriate, as Jupiter is more than twice as massive as all the other planets put together. Its great globe could contain 1,300 bodies the size of the earth.

A Guide to the Planets copyright 1954 by Patrick Moore and published at $4.95 by W. W. Norton & Co., Inc., 101 Fifth Ave., New York 3, N. Y.

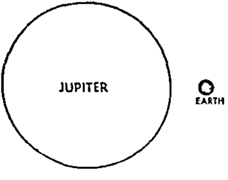
Even though it is so remote, Jupiter appears as a splendid object i our skies. It is brighter than an other planet apart from Venus an (very occasionally) Mars. It move very slowly compared with the earth Jupiter's own "year" is almost 1 times as long as ours, so that no be ing with a life span comparable t our own would survive to celebrat his ninth birthday.

Jupiter's equatorial diameter i 88,700 miles, over 11 times that of the earth, but even a small telescope will show that there is considerable polar flattening. The polar diamete is, in fact, only 83,800 miles. There is a simple explanation of this. Al though Jupiter is the largest plane in the solar system, it has the shortest axial rotation period—less than ten terrestrial hours—and so is spinning at a tremendous rate; particles at the equator are whirling around at no less than 28,000 miles an hour. Centrifugal force is so strong in the equatorial zone that it causes the whole zone to bulge out, forcing the planet into the shape of a somewhat squashed orange.

This marked flattening shows that Jupiter cannot be solid in the sense that the four inner planets are. This is confirmed at once by telescopic observation. We look down not upon a solid surface with mountains, plateaus, and deserts, but upon a sea of clouds—shifting and changing unceasingly. Jupiter's "atmosphere" is very deep. Indeed, it is by no means certain that the planet has a proper solid surface at all.

In a way, it is misleading to speak

if the outer cloud layers of Jupiter is an "atmosphere." More accurately, it is part of the body of the planet, for Jupiter is not so heavy as might be imagined from its vast size. Its average density is only ¼th of that of the earth, and only 1⅓ times as great as water; and though it has a powerful gravitational pull, it is only 317 times as massive as the earth. It would take over a thousand Jupiters to make one body as massive as the sun.



COMPARATIVE sizes of the planet Jupiter and our own planet, the earth.

The Jovian clouds are quite unlike those of the earth. Both the two gases which seem to be present there in vast quantities are most obnoxious from our point of view. One of them is ammonia, familiar to most people (ordinary household ammonia consists of the gas dissolved in water), and the other is methane, known commonly as marsh gas. Like ammonia, it has a strong, unpleasant odor. Altogether, the atmosphere of Jupiter seems to be offensive, to put it mildly.

However, the real significance of the ammonia and methane is that both are hydrogen compounds. Hydrogen is easily the most abundant element in the universe, and undoubtedly both Jupiter and the earth possessed a great deal of it in their extreme youth. The earth's hydrogen leaked away; Jupiter's, held down by the crushing gravitational pulls, did not, and much of the gas combined with other elements to form the dense, poisonous, ammonia-methane atmosphere of today

Oxygen gas is lacking on Jupiter. It seems probable that most of the original oxygen has combined with yet more hydrogen to form water, and deep down below the outer gas there may well be a thick ocean of ice.

As we cannot see below the uppermost layers of Jupiter's gas clouds, all we can do is to form a picture of the structure of the planet by indirect reasoning. Dr. Rupert Wildt, of Yale University, considers that the general structure is a rocky, metallic core overlaid by an ice layer, which is in turn overlaid by the ammonia-methane-hydrogen atmosphere This theory was generally accepted until very recently

If Wildt's model is correct, strange things must be happening at the bottom of the gas layer The pressure must be crushing — far beyond our experience—and although still gaseous in the technical sense, the material must tend to behave much more like a solid. The surface temperature is known; it is about —200 degrees Fahrenheit, which is below the freezing point of ammonia, so th clouds themselves seem to co

small ammonia crystals suspended in the atmosphere—much as ice crystals are held in terrestrial clouds.

Until the present century, it was commonly believed that Jupiter had some light of its own, and did not rely wholly upon the sun; but this is definitely not the case. The surface temperature is just about what would be expected if the surface was warmed only by the sun.

Doctor W. R. Ramsey does not support the Wildt rock-ice-gas model. In his opinion, Jupiter consists mainly of hydrogen, and this seems eminently reasonable when we bear in mind the great preponderance of hydrogen in the sun and stars. If hydrogen is responsible for 80 percent of Jupiter's mass, there will be no fundamental difference between the center and the outer layers, except that the terrific pressure near the center will compress the hydrogen gas so much that it will actually start to behave like a metal, not like a gas at all.

At the moment, it is impossible to decide definitely between the Wildt and Ramsey models; but one of them is probably correct. What we do know for certain is that Jupiter is built upon a pattern very different from that of the earth; it is clear that any form of life as we know it is impossible there.

Jupiter's cloud layers abound in detail. This detail is constantly changing, and is easy to observe even in a small instrument, so that the Giant Planet is without doubt one of the most fascinating of all telescopic objects.

The most conspicuous markings on the yellowish flattened disk are the cloud belts. There are a number of these running straight across the planet, and all drawings and photographs show them prominently.

At a casual glance the belts appear as dark, regular lines, but close examination shows that they are far from regular. They reveal considerable structure; brighter and fainter portions, knots, divisions, spots and notches. Details in the belts often persist for days on end.

Spots are very common on Jupiter, but one of them, the Great Red Spot, is of particular interest owing to its long life.

It first became prominent in 1878, developing from a pale pink, oval object into a brick-red area 30,000 miles long by 7,000 wide—so that its surface area was equal to that of the earth.

The startling red color did not last for more than a few years, and since 1890 the Spot has faded considerably. It became prominent again for a while in 1936—and some observers still call it pinkish at times, though personally I have never seen it anything but gray.

The Spot drifts about, within cer-

PATRICK MOORE is one of the leading young astronomers of the world. He holds the ranks of council member of the British Astronomical Association, Fellow of the British Interplanetary Society, member of the Irish Astronomical Society, member of the Association of Lunar and Planetary Observers, and corresponding member of the Planetensektion der Sternfreunde.

tain limits of longitude, and has been known to shift some 20,000 miles to either side of its mean position. It may well be a solid body of some sort floating in the atmosphere, and this idea would also account for its variations in prominence, since when lower down—and hence covered by more of the atmospheric gas — it would naturally appear less noticeable

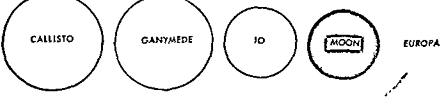
Most of the other Jovian features are short-lived, lasting for a few months at most, though now and then objects of particular interest are seen.

One other feature of greater persistence should be mentioned. This is the South Tropical Disturbance, a dark area in the Red Spot zone which has been seen almost continuously since 1901 It is slightly closer to the equator than the Spot is, and has a slightly shorter rotation period, so that every two or three years it actually overtakes the Spot and passes it. While this is going on, there is a marked interaction between the Disturbance and the Spot; the Disturbance tends to accelerate, and as it passes by it seems to drag the Spot with it for several thousands of miles When the Disturbance has gone on its way, the Spot drifts slowly back to its original position

We have no real idea of how the belts and spots arise. Great volcanic upheavals have been suggested, but until we know more about the inner structure of the planet it is really pointless to speculate.

It does at least seem certain that we shall never be able to land on Jupiter. Apart from the coldness, the poisonous gas mantle, and the generally unfavorable conditions, the gravitational pull renders all Jovian expeditions totally out of the question. Escape velocity is 37 miles a second, so that the task of taking off again, once we had landed, would be a hopeless one, moreover a human being would feel alarmingly heavy—a man who weighed 200 pounds on earth would weigh 514 jounds on Jupiter If we are to visit the Jovian system at all, we must resign ourselves to keeping well clear of the Giant Planet itself and making our investigations from a base upon one of its satellites

When Galileo first turned his newly made telescope to the heavens in 1609, he saw that Jupiter was attended by four starlike objects that soon proved to be satellites. Simon Marius, who observed them at about the same time, christened them Io, Europa, Ganymede, and Callisto.



SIZES of four of Jupiter's satellites, compared to the moon. The seven satellites of the giant planet are too small to be shown on

All four satellites can be seen with any small telescope, and there are plenty of records of naked-eye observations of them, so that obviously they must be fairly large. The most recent values for their diameters are 2,310 miles for Io, 1,950 for Europa, 3,200 for Ganymede, and 3,220 for Callisto, so that only Europa is smaller than our moon. Both Ganymede and Callisto are appreciably larger than the planet Mercury, though not so massive.

Io, closest in of the four, is slightly more massive than our moon, and has an escape velocity of 1⅓ miles a second. It is 262,000 miles from Jupiter, but the tremendous gravitational pull whirls it right around the planet in only 1 day 18½ hours.

Europa, the second satellite, is smaller and less massive than Io; but it appears almost as bright, so that it is even more efficient as a reflector of sunlight. Indeed, it seems to reflect about 75 percent of the light falling upon it, and its surface must therefore be coated with a substance which glitters and sparkles in the pale radiance of the faraway sun.

Ganymede, third and brightest of the Galileans, is strangely lacking in mass for its size. It seems to be a planet in dimensions, but a satellite in weight; certainly it is more massive than the moon, but even so its escape velocity is only 1¾ miles a second. Superficially, the appearance of Ganymede is rather like that of Mars. However, not even the most ardent supporter of "life on other worlds" would attribute the Gany-'an dark areas to vegetation. Apart from the bitter cold, Ga[...]mede is almost or quite airless.

Callisto, the outermost of the G[...]leans, is in many ways the most [...]teresting of the four, since it is b[...] the largest and the least massi[...] Recent measures of its diame[...] make it slightly larger than Ga[...]mede and much larger than M[...]cury; yet it has only half the ma[...] of the moon. Some astronomers ha[...] suggested that Callisto is a sort [...] celestial snowball, made up of ic[...] loosely packed materials; but on t[...] whole it is more probably compos[...] of a core of light rock—pumice, pe[...]haps—overlaid with a layer of ic[...] Owing to the low escape velocity, [...] is unlikely to have retained any a[...]preciable atmosphere.

The eight remaining moons [...] Jupiter are very small, and cann[...] be seen except with very large instr[...]ments. They remain unnamed, apa[...] from the fifth, which seems to hav[...] become known as Amalthea—a nam[...] which is still "unofficial."

Amalthea is of definite interest. I[...] was discovered by Prof. Barnard i[...] 1892, and is closer in than any of th[...] Galileans; it is about 112,000 mile[...] from Jupiter's center, and thus onl[...] about 70,000 miles above the oute[...] cloud layers. It has a revolutio[...] period of only 12 hours, and is abou[...] 150 miles across.

From Amalthea, Jupiter would b[...] a truly noble spectacle, covering [...] quarter of the sky—its belts, spots [...] and turbulent clouds spread out i[...] magnificent panorama against th[...] starry background. Perhaps in th[...] distant future men will go there an[...]

see these wonders for themselves. The sight of Jupiter in the Amalthean sky will be well worth the journey of 400 million miles.

We know that landing on Jupiter is beyond our powers, but will it ever be possible to visit any of the satellites? There seems no reason why not, and in the far future there may well be a manned base on Io, Europa, or even Amalthea; but we must remember that Jupiter is a long way away, so that unless we can attain improbably high velocities, a round trip will take six or seven years.

For ourselves, and for generations of men to come, there can be no hope of seeing the wonders of Jupiter from close range. We must be content to look at the king of planets from a rsepectful distance, and leave him alone in his cold, proud glory.

Why Leaves Change Color and Drop Off

In the autumn tree leaves die and drop off it is true but the trees themselves are no more dead in fall and winter than they are in spring and summer

The trees, as a matter of fact, are very business-like about this letting their leaves go. In their purely automatic, unconscious way they prepare for the coming winter and the spring that is to follow

The first thing that happens, as the nights grow long and chillier, is the draining back into the tree's branches and trunk of practically all the foodstuffs in the leaves Leaves are the ultimate food factories and during their active life always contain a good deal of sugar, starch and protein That is why grazing and browsing animals eat them while they are green — nobody ever saw a deer, or even a goat, try to get a living out of fallen leaves.

After the foodstuffs have been drained out of the leaves, the green coloring matter that helps to make them breaks down chemically, and in doing so becomes colorless. It is then that the leaves begin to glow in their autumn glory of yellows and reds and purples

These colors have been there all the while, the yellows as microscopic solid bits of pigment, the reds and purples as dissolved dyes in the cell-sap. Only during the summer there is so much more of the green pigment in most leaves that it masks the bright hues.

While the color change is going on, a double layer of cork cells forms right across the base of the petiole, or leaf-stem—the only common case in nature of a bandage being applied before a wound occurs.

After this cork layer is formed, it splits apart, one half going with the leaf, the other covering the scar on the branch and sealing it against the entry of decay-causing germs and spores Students of plant life call this cork layer the "absciss layer," which in plain English means simply the layer"

And so the leaves drop off.

CHEAP A-POWER

FOR BRITAIN

by Lin Root

Condensed from The Reporter

On some as yet unspecified morning early next year, electricity generated from the heat of nuclear fission will start flowing through British wires. The woman snapping on the heater in her chilly bedroom in Liverpool and the man throwing a switch in a factory at Leeds will release power some of which will have had its beginning in smashing atoms. The current itself will be exactly the same as the current from conventional coal-fired plants and will be pooled with it—but its source will power the Second Industrial Revolution.

When Great Britain started the First Industrial Revolution in the 18th century, coal was fairly bursting out of the ground. As long as coal was plentiful Britain kept its industrial leadership — manufacturing, exporting, colonizing, changing the face of the world. Then the coal seams ran thin, and Britain fell behind in the modern industrial race.

The United States, unearthing its own great treasures of coal, oil and natural gas, took the lead. Since 1900 the United States has doubled its energy requirements every ten years—about twice Great Britain's rate of increase.

Every American worker today has at his disposal three times as much electrical energy as every British worker. Or put it this way: The power behind every American worker gives him the strength of 200 men while his British opposite number is limited to the strength of 66 men.

Now Great Britain will inaugurate this Second Industrial Revolution with the world's first full-scale nuclear power station: Calder Hall on the coast of Cumberland. The Calder Hall Power Station, affectionately known as "Pippa" (Power for Industrial Purposes), was started in June, 1953, and will be completed ahead of schedule. The latest date is early in 1956, but it may be oper-

The Reporter (June 30 '55), 220 E. 42nd St., New York 17, N. Y.

ating by Christmas of this year.

Last February 15, Geoffrey Lloyd, Minister of Fuel and Power, announced in the House of Commons that the government had decided to embark on a program of big nuclear-power stations. A ten-year provisional program is in effect for the building of 12 nuclear power stations with a total capacity of 1.5 to 2 million kilowatts of electricity a year—the power equivalent of 5 to 6 million tons of coal. (In addition, Mr. Lloyd told the House June 13 that six more reactors will be constructed to make both military materials and electricity)

The work of designing the stations and training the technicians to run them has already begun but the actual construction of the stations to follow Calder Hall will not start before 1957. Then the program will move forward rapidly

The first four power stations will each have two reactors. All eight reactors will be of about the same size and type as the one at Calder Hall, with improvements The next four stations will have one reactor each, probably of a further improved Calder Hall type but with several times its output The last four stations will be of a more advanced type which has not yet been tested full-size.

The estimated cost of generating electricity will be one ha'penny (7⁄10ths of a cent) per kilowatt-hour. This is about the cost for electricity generated by the most modern British coal-fired stations, and about the median cost for electricity here.

When I was in England in October 1954, the most optimistic estimate was one English penny per kilowatt-hour. Since then, the estimated cost has been cut in half by the valuable lessons learned at Calder Hall, tighter cost accounting, and—most important — the establishment of what is known as "plutonium credit."

Plutonium is as important for power as it is for bombs—but in a different way. It is a man-made element, practically nonexistent in nature. It was first produced artificially at the University of California, Berkeley, 1940, and is created when fission takes place in natural uranium (Natural uranium contains 1 part of the fissionable U-235 to 140 parts U-238.)

In its turn, plutonium is fissionable It can do everything U-235 can do, only better. For one thing, it is much easier to extract pure plutonium from the natural uranium mass than it is to separate out pure U-235 For another, man-made plutonium can be produced in quantity and at will. Plutonium, therefore, serves as a relatively cheap substitute for U-235.

From a military viewpoint, the emphasis has been on stockpiling plutonium for bombs and experiments. The heat generated in the process was a nuisance by-product

From an industrial viewpoint, plutonium is the by-product The main emphasis is on heat, which, inst of being driven off up the ch is now drawn off by a coola through the pile and into to produce electricity.

um can then be used to enrich natural uranium, speeding up the reactions; can go into "breeder" reactors, which create more fissile atoms than they consume (the ultimate pie-in-the-sky machines); can go on making bombs; and will surely perform other miracles in the future as its uses are explored.

Calder Hall has two converter reactors of about 50,000 kilowatts each, which work on natural uranium, producing heat and converting the non-fissionable U-238 into fissionable plutonium, which is thus available for sale.

Putting a realistic price on plutonium was a headache. Its military cost had been high, and top-secret. Early in its civilian career, it will be scarce and therefore costly—although nowhere near as costly as when produced for military use.

As the system gets under way, the volume of plutonium will increase and its cost will decrease—how much and how soon is nobody's guess. (It should always be worth at least 140 times the price of natural uranium, which is only 1 in 140 parts fissionable.) It is understood that a "plutonium credit" of several thousand dollars per kilogram (2.2 lbs.) will be allowed against costs for the early period; and since 1 pound of plutonium is the equivalent of something like 1,500 tons of coal, the bookkeeping seems realistic.

The future drop in the price of plutonium will be more than offset by the increased efficiency of reactors, and electricity should become ever cheaper. It is expected that toward the end of the ten-year plan the stockpile of plutonium will be such that all subsequent reactors will run on enriched uranium or will be "breeders."

Britain's organization of atomic affairs is in some ways similar to our own. The Atomic Energy Authority, like our AEC, will give technical advice and control strategic supplies. The Atomic Energy Research Establishment at Harwell will continue research and experiment on varied reactors and related problems. Private industry will build the plants. The big difference between the United States and Britain is that the nationalized British Electric Authority will own and operate the stations. This immense utility works must show a balanced budget over the years. When it shows a profit, as it has for the last few years, it goes back into the business, either to lower or to hold prices or to finance improvements.

The cost of the ten-year program was tentatively set at $840 million. (Actually the total spent will be more, because it will include expenditures for stations that will be started but not completed within the ten-year period.) This sizeable sum will not be a completely new demand on the economy. Many coal-fired stations are obsolete and the whole power system is inadequate for Britain's productivity. Modernization with new coal- and oil-fired plants is figured to run close to $3,360 million over the next ten years. The nuclear-power program will cut this significantly and will also give the National

Coal Board a welcome breather.

Plans for the following ten years are optimistic but necessarily vague. A full-scale reactor of the advanced "breeder" type has been under construction for almost a year now at Dounreay in the north of Scotland. It is hoped that it will sound the keynote for the reactor program 1965-1975. By 1975, nuclear-power stations should have a capacity of 10 to 15 million kilowatts, or the equivalent of 40 million tons of coal a year. By then Great Britain will be using 4½ times as much electricity as in 1950, and the British worker will be well on the way to having as much power behind him as his American counterpart in industry.

The Calder Hall type of reactor, on which Britain is concentrating at the beginning, uses carbon dioxide gas under pressure as the coolant to carry off the heat that makes the steam. This is not the simplest, cheapest, or most efficient type of reactor, but it is the safest and the easiest to run.

The design was worked over for two years at Harwell and is considered the best answer to Britain's immediate needs Great Britain has no wide-open spaces in which to build reactors that have even the slightest possibility of "running away."

Also Britain is driving straight for the most practical reactor. To be efficient, a power supply must be as close as possible to the area supplied. And Britain wants a reactor that can be fueled by natural uranium. "Pippa" fulfills these specifications.

Also, according to a White Paper, the new reactors will "present no more danger to people living nearby than many existing industrial works that are sited within built-up areas "

I have heard some professional criticism here of Britain's policy of making standardized small reactors and running them in multiple units for heavily industrialized areas instead of going in for the huge reactors that figure in American plans. But again Britain is not waiting to shop around for the best in fulfilling the immediate program. Harwell will continue to do research on other types. Meanwhile, factories will be turning out the type that is well-known and has proved satisfactory; the Model T of reactors—good enough not only for domestic uses but also for export, with attendant prestige.

• As a matter of fact, the new sources of atomic energy offer so many opportunities for advance that we are now facing the dawn of a new era in chemistry and biology —James Franck

From the very outset of Great Britain's atomic-energy program, the vision of its planners went beyond the British Isles.

The first and simplest application was the use of radioactive isotopes. Knowing there would be a large world market, special provision was made for producing them in quantity from the very beginning in 1946.

Today Great Britain leads the world in the export of isoto
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tion to 40-odd countries.
States exports less than

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as much — though the radioactive content of our shipments may be *relatively greater.*

Many smaller industrialized countries know all too well how lack of power cramps and dwarfs them. These countries are a natural market for the medium-size, medium-price, ready-made reactor—the kind Great Britain is specializing in.

The underdeveloped countries are even more favorable areas. When uranium was discovered in South Africa, all kinds of machinery had to be ordered from other countries for its production. In all quarters of the world there are enormous needs for power. In areas where there are no natural resources like coal and water, atomic power seems the most promising possibility.

For all these countries, small reactors are necessary—individual outfits that can be placed wherever needed.

Great Britain's world position depends on close ties with the other Commonwealth nations. Furthermore, they have good supplies of the uranium, thorium, and other necessary metals that Great Britain lacks. The Commonwealth countries will doubtless be among the first to be favored with British nuclear-power plants. In return, Great Britain will be assured of ample reserves of nuclear fuel. Already a formal exchange program has been announced between Britain and Australia.

Many of us in the United States think that simply because our atomic-energy program is the biggest (over $8 billion, to date), our skill and knowledge must also be the most comprehensive and that we can easily *apply them to industrial use* whenever we wish. Perhaps we can, but not without enormous cost.

Some British specialists intimated that just possibly we have been bewitched by bigness into overlooking corners that could be cut without impairing efficiency. They freely grant that we know more about reactors than anyone else in the world, but much of the information is in the money-is-no-object department. Until we can do it "on the cheap," as the British say, we shall be priced out of the market.

Britain's whole effort has been "on the cheap" and is directed at producing practical power at the earliest possible date. Our five-year AEC program, with its emphasis on variety and efficiency of reactor design, is by comparison a longer-range experimental program—a kind of exercise in technological perfectionism

Britain's plan was laid down early and carefully. The goal was clear—electricity for the national grid, to provide domestic light, heat, and power. Nuclear-powered planes and ships would have to wait.

The method was daring: The British plunged into atomic energy without the means, the manpower, or the time to take it in easy stages. They jumped from the laboratory bench straight to the full-scale plutonium-separation plant and started building it while the chemical engineers were still figuring answers on how to handle highly-active fission products Very unorthodox, but it worked.

a science milestone

ALEXANDER von HUMBOLDT Grand Old Man of Science

by Christopher Matthew

Condensed from The Milwaukee Journal

MOUNTAIN CLIMBING as a sport may be said to have begun in Ecuador in June, 1802, when Baron Alexander von Humboldt and three companions ascended Mount Chimborazo, then thought to be the highest mountain in the world.

Most of the climbing had to be done along a narrow ridge bordered by crevasses through mist and snowstorm, it being the rainy season But as the weary climbers neared the summit, the mist suddenly rose and "the grand and solemn spectacle of dome-shaped Chimborazo" loomed above them.

Eagerly they pressed on until, at a distance "about three times the height of St Peter's" from the top, they were stopped by a ravine 400 feet deep and 60 feet wide The barrier proved insurmountable Taking measurements, they found they were 19,285 feet above sea level, the highest altitude ever reached by man up to that time.

When news of the ascent was first published in a Paris journal some months later, the baron, who already enjoyed half a dozen reputations, acquired another His feat gave the first impulse to a number of other mountaineering expeditions, including a famous English one to the Himalayas 30 years later.

When Humboldt heard that the mountains of Asia were considerably higher than those of South America, he wrote

"All my life I prided myself on the fact that of all mortals I had reached the highest point on earth. It is therefore with a certain feeling of envy that I learned of the accomplishments of the English."

But instead of spending time in vain regrets, he set out, at 60, on another jaunt into the heart of Asia to see the Himalayas for himself.

• • •

Friedrich Heinrich Alexander von Humboldt, son of a Prussian army major, was born in Berlin on September 14, 1769. Darwin called him "the greatest scientific traveler who ever lived" More geographical features have been named after him than after any other man of science. Counties in Iowa, Nevada and California, and cities in seven other states bear his name Besides these, there are some two dozen Humboldt peaks, parks, streets, mountain ranges, glaciers, reservoirs and marshes, the great Humboldt Current coast of Peru

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The Milwaukee Journal Milwaukee 1, Wis

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hard lot affected him deeply. He wrote:

"During the fall and winter of 1793, I was constantly kept in such a state of agitation that I could never see the lights of cottages, shining as they were through the mist of night, without much emotion."

Wherever he went he collected stones, fossils and plants. On his South American trip he preserved 6,000 species of plants, including 3,500 new ones. He was just as interested in animals and human races. He laid the groundwork for half a dozen sciences, including meteorology, geography and anthropology.

Humboldt's delineation of "isothermal lines" (1817) furnished a means for comparing climatic conditions between nations; he investigated the origins of tropical storms, and the laws governing atmospheric disturbance in higher latitudes. He discovered the decrease in intensity of the earth's magnetic force from the Poles to the Equator; and he made a pioneer and far-reaching study of the volcanoes of the New World. He was an important investigator of the effect of geographical environment on the distribution of plants A detail: his writings were mainly responsible for the introduction of guano (for use as a fertilizer) into Europe.

In the privacy of his study, he tested the effects of electric currents on nerves and muscles, first frogs and then the muscles of his own back in a series of painful experiments. After 4,000 tests, he presented his findings in a book—a typical procedure with Humboldt.

Possibly no man ever noted and cataloged what he saw more accurately, or published the results more voluminously. The books on his American travels ran to 30 large volumes and sold for $2,000 unbound. Yet the set had a good sale among libraries, governments and wealthy collectors.

• All mankind together is making a continual progress in proportion as the universe grows older. So that the whole human race, during the course of so many ages, may be considered as one man who never ceases to live and learn —Pascal

Humboldt's journey through the Americas was an Odyssey. Like Columbus, after trying in vain to interest a number of courts in backing a world exploratory tour, he finally won the approval of the Spanish king for a tour through Latin America. Armed with two passports and the latest scientific instruments, and accompanied by the French botanist Aimé Bonpland, he left La Coruna in 1799, slipped through the English blockade—the Napoleonic wars had begun — and eventually landed in Venezuela.

During the next five years — to mention only a few highlights—he explored the Orinoco and upper Amazon valleys, climbed Chimborazo, studied Inca civilization Peru, concluded that Indians ar Asiatic origin and that there such thing as an inferior race.

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1769 — FRIEDRICH HEINRICH ALEXANDER von HUMBOLDT — 1859

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In addition, he became an ardent antislavery advocate and visited with President Thomas Jefferson, a man after his own heart, both in Washington and Monticello. Then he slipped through the British blockade again and arrived in Paris in 1804 with chests full of specimens and notes and a reputation that made him one of the celebrities of the French capital during the Napoleonic era.

The king of Prussia tried hard and, at last, successfully to lure him back to Berlin, where he became a court chamberlain with permission to continue his travels whenever he felt the urge. The most extended of these was a tour subsidized by the czar of Russia into the interior of Asia in 1829. In that year his proposals to the Russian government led to the establishment of meteorological stations across northern Asia. He discovered a diamond field in the Urals, but chafed at the restrictions imposed on him by Russian officials, who seem to have been as oppressive then as now.

At the borders of China he was welcomed as a new Marco Polo by an emissary of the Chinese emperor. The thing that impressed this mandarin most was a pencil carried by his guest. Humboldt made him a present of it.

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During his last years Humboldt summed up his ideas about nature in a five-volume work entitled *Cosmos*. In Germany its place is something

like that of Thoreau's *Walden* here. Although Humboldt's writings had influenced Darwin, *Cosmos* presents the universe not as a struggle for the survival of the fittest but as a harmonious whole.

Humboldt had become the grand old man of science in Europe. Visitors from other countries, including America, came to pay homage to him. A linguist, Humboldt conversed with them in their own tongues

Prescott, inspired by Humboldt's writings, began to write his histories of the conquest of Mexico and Peru. Agassiz brought the Humboldtian gospel of nature to Harvard.

Humboldt remained modest in spite of honors The queen of Prussia, out for a ride, once mistook him for a tramp while he sat at the roadside chipping rocks with a geological hammer and sent her footman to give him a coin.

He died at the age of 90, on March 6, 1859, and was given a magnificent state funeral by order of the prince regent, later Emperor William I. He was buried in the flower garden at Tegel. The mansion had been rebuilt, but was presumably still protected by lightning rods.

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Humboldt is the subject of the recently-published biography, *Humboldt· The Life and Times of Alexander von Humboldt*, by Helmut de Terra. (Knopf, Inc.)

How To Recognize Polio at the Start

In his book *Better Health for Your Children*, Dr I Newton Kugelmass, a well-known New York pediatrician, makes it plain that only a physician of good judgment and large experience will recognize polio in its earliest stages.

At a time like this, when the whole country is talking about vaccines and about protecting children the inexperienced physician is more likely than not to decide that the case which he is called to consider is poliomyelitis.

Polio strikes quickly· that is in a matter of 5 to 20 days The symptoms are fever, headache, sore throat, vomiting, abdominal pain, listlessness, stiff neck, sore arms and legs All these signs are not present at the same time Nor do they necessarily point to polio In fact, they are just as characteristic of influenza and some other virus infections, says Dr. Kugelmass

Though he is no believer in household remedies or grandma's kind of medicine, Dr. Kugelmass advises worried mothers to carry out a few simple tests Can the child put his *chin to his chest?* Can he kiss his knee? If he can do both, the chances are that he is not a case of polio If he is too sick to cooperate send for the doctor, is Dr Kugelmass' advice

• • •

Polio means paralysis to every mother But about 60 percent of the children who contract polio in recognizable form recover without any visible evidence of paralysis Another 25 percent will recover with only so mild a form of paralysis that there is hardly any physica disability Only 15 percent wi handicapped — *unable to use* s their muscles

—*Waldemar Kae*
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Kaempffert[illegible] *[New] York Tim[es]*

Inventions Patents Processes

Plastic Solar Stills Provide Fresh Water

One likely method visualized for utilizing solar energy to obtain fresh water by distilling brines involves the construction of solar stills from plastic film, if such stills can be constructed cheaply. Part of the Department of Interior's Saline Water Conversion Program to determine improved design for plastic solar stills and the proper plastic film to use is being carried out by the Bjorksten Research Laboratories, Inc., Madison, Wis

Solar stills for obtaining fresh water from brine were used in South America for supplying drinking water for pack animals back in the 1800's. More recently, small plastic solar stills have been developed by Maria Telkes for emergency use on life rafts at sea.

Economical use of solar stills under less specialized conditions must await the development of more efficient low-cost equipment, however. If cheap solar distillation processes can be worked out, they could be used to obtain drinking or irrigation water in many places in this country where only brackish water is available, in countries in the Mediterranean area, or on tropical islands with limited fresh-water resources

Most solar stills constructed so far consist of a shallow chamber, or porous pad, containing saline water and covered by a transparent roof which leaves a relatively large vapor space. Sunlight passes through the roof and is absorbed by the saline water at the bottom of the apparatus. The vapor then condenses on the transparent roof and the condensate moves down the sloping roof to be collected in a suitable trough.

Because they are easy to support and assemble, plastic stills have an advantage over glass ones, even though yields may be less.

—*Industrial and Engineering Chemistry*

Bag Absorbs Shock in Parachute Drops

A newly developed collapsible rubber bag that resembles a barrel will greatly increase the striking power of paratroops and may help the joint efforts of the Air Force and Army to deliver more equipment to ground troops.

Designed and manufactured by The Firestone Tire & Rubber Co, the "Aero-Pallet Cushion" absorbs the landing shock in parachute drops of heavy weapons and equipment.

Here's how it works:

From 4 to 10 Firestone air cushions are placed underneath a magnesium pallet carrying up to 25 000 pounds of equipment. When such a load is dropped from a cargo plane, a rush of air fills the cushions, before automatically closing diaphragms that keep them inflated. On hitting the ground, compressed air in each cushion bears the brunt of shock, then forces out a rubber cork-like plug which decompresses the bag—like an air-filled pillow.

Air Force tests at El Centro, Calif., have proved that such air bags cut ground impact by two-thirds. A 1,000-lb load hits with a force of 12 000 lbs. instead of 35 000

The reduction in landing impact ·eans that equipment such as jeeps, ılldozers and weapons now can with-and greater landing forces under high-ınd conditions

lizzard Tunnel
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Study of pattern and rate of ice for-ıation to reduce in-flight icing condi-ons is now being conducted in a oughnut-shaped $160,000 "blizzard ınnel" located at the Lockheed Air-raft Corp plant in Burbank, Calif

Although the installation is 76 feet ong, 26 feet wide and 17 feet high, the eck of the tunnel's central section is nly 2½ feet wide and 4 feet high Vhen a big 7-foot-diameter fan pushes ir from the main section through re- igerated coils into the small test area, ıe constriction speeds the flow of air rom 15 to 270 miles per hour. Nine pray bars introduce water to the frosty ir current after it moves through a 5 x 9-foot refrigeration unit In actual :sts, temperatures may drop to 35 de-rees below zero

Walls are of ⅜th-inch structural steel plate, welded into 10 sections and bolted together on the site, reinforced by transverse timber framing Tunnel is insulated through 4-inch-thick cork applied to the exterior and carefully protected by a mastic coating

Lockheed's newest transport, the turbo-prop C-130, will benefit first from the tunnel investigations Part of a full-scale C-130 outer wing panel was subjected to exhaustive analysis of its de-icing equipment to check engineer-ing design work on the craft Facility is also being used to test a number of still-secret models now in design and mock-up stages, the company reports

—*Industrial Laboratories*

Glass Paper Filters Smoke

A National Bureau of Standards sci-entist rolled his own cigarettes with a new glass-fiber paper he and his associ-ates have developed When he smoked one he found that he had a cigarette with a built-in ash tray The paper would not burn, but held the ashes in place until he was ready to throw the cigarette away

The new paper, made from glass fibers a 1/50 000th of an inch thick, is one of the best smoke filters known. When used as a cigarette filter, it al-lowed only 1 smoke particle in 100,000 to pass through This, of course, would ruin the smoke. You might just as well not light such a cigarette. The filtering properties, however, make the paper ideal for gas masks and air conditioners

In its raw form, the paper looks like blotting paper It has a smooth, almost silky texture and is crease-proof You can crumple it in your hand and, just by running a finger over it, the paper will return to its original flat shape The process can be repeated many times without injuring the sheet

It is 8 times as strong as previous glass papers and is prepared by the same process used to make newsprint.

The very fine threads used in the new paper are made by forcing molten glass through tiny holes, then stretching the fibers in hot air

Ironically, the new paper is no good as paper It would be like trying to write on a blotter, the scientists said.

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A tiny new electronic device mad extremely pure silicon shows pro reducing costs on a large scale i industries using electric pow Telephone Laboratories report.

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Tiny Rectifier

A tiny new electronic device made of extremely pure silicon shows promise of reducing costs on a large scale in many industries using electric power, Bell Telephone L [illegible] report.

The simple [illegible] silicon power

rectifier — converts alternating current into direct current.

Despite a trend in recent years toward smaller and more efficient components, power rectifiers have remained large, limited in efficiency and in need of bulky cooling equipment to prevent overheating

Bell scientists believe that the new power rectifier will far surpass any yet made of silicon or other material They expect it may have an almost unlimited life span, and will be capable of operating continuously at temperatures up to 400° F.

These advantages are expected to open up many new uses in telecommunication, heavy industry and in military applications. The rectifier's efficiency —more than 98 percent of the theoretical limit—was made possible by recent work of M. B. Prince, a Bell Laboratories physicist.

Two of the new rectifiers, when made about the size of peas, linked together, and mounted on a cooling fin, will furnish more than 20 amperes of direct current at 110 volts. This amounts to 2,000 watts — with only 20 watts lost through heat.

Only 1 ampere or less is needed to run a radio or television set, or to operate a group of telephone switching relays. To charge storage batteries used in automobiles and telephone central offices or to operate electric motors, from 10 to more than 100 amperes may be needed.

Highly purified silicon is a costly material when bought in pound quantities, but such minute amounts are used in the new rectifier that the material becomes relatively inexpensive to use A rectifier the size of a pea contains a silicon wafer which is only 1/5,000th of an inch thick and around 1/10th of an inch square.

Speaker Without Membran

Engineers at Hanover, Germany perfecting a loudspeaker that ha vibrating membrane Instead, it u pocket of ionized air to obtain h fidelity.

An ordinary loudspeaker has a shaped membrane which excites ne air to create a sound. The inert this cone causes distortions in repro tion. The vibrating pocket of air i new loudspeaker, called the Ionopl will create the sound without this back, the designers say

The Telefunken Co. of Har hopes to develop a commercial m of the device, invented by M. S. of Paris.

Better Transistors

Better transistors to replace va tubes in such high-frequency us television, shortwave radio and have been developed.

Doctor C. G. Suits, research dir for General Electric Co, said tha new, improved transistors can op efficiently at frequencies 5 times h than ordinary transistors. At these frequencies, they amplify current eral hundred times, compared to of about 50 times for ordinary t sistors.

Doctor Robert N. Hall develope "meltback" process for making the ter transistors Using it, thin wire crystals are quickly cooled to give crystals in less than a second Pr commercial methods for making sistors involve cutting larger cry into smaller ones.

Ultrasonic Waves Keep Honey Fresh

Honey can now be kept from spo by subjecting it to ultrasonic wav

Crystallization, the first step in honey deterioration, is prevented by ultrasonic waves, reports Dr. Socrates A Kaloyereas of Louisiana State University's agricultural experiment station

It was found that ultrasonically-treated honey, stored from 1 to 4 weeks at temperatures ranging from —40° F. to 102° F., showed no signs of crystallizing. Untreated control samples on the other hand, showed spoilage signs.

In addition to keeping the honey fresh, ultrasonic waves also improve its taste, giving it a slightly tart flavor, described "superior" to untreated honey.

The experiments also show that yeast cell growth is retarded by the ultrasonic wave treatment.

Doorless Stores

The housewife, struggling with shop doors while laden with bundles, will welcome new plans for doorless markets of the future

A curtain of air, warm in the winter and cold in the summer, would keep out the elements But the shopper will be able to walk right through the flowing air as if it were not there

Conditioned air would move between a vent at the top and a grating in the floor of the completely open store-front, according to plans now on the drawing boards of the National Association of Food Chains This glimpse into the

doorless market, many a scratch will be avoided by an automatic "brain" that will park the car Dreamed up for publicity by the American Iron and Steel Institute, the auto of the future would also be equipped with electronic devices to alert the driver to road conditions far ahead —*Science Service*

Electric Baseboard Heater

Comfort and convenience in home heating are embodied in a new development announced by Westinghouse

An electric baseboard heater capable of meeting the requirements of any climate, economical to install, operate and maintain, "scorch-proof" and attractive, is now available to home owners and building contractors

Subjected to months of testing, the baseboard heaters can be operated with furniture placed flush to them or with draperies hung above or against them Maximum temperature of the vertical outer surface is approximately 100° F, just above normal body temperature

Installed in 2-foot sections, as many units are used in each room as engineering specifications require A control panel is coupled into the heating system of each room, allowing room-by-room use and conservation of heat They can be used in a single room or throughout the house There are no moving parts

Wiring required for the baseboard heaters is identical with 240-volt circuits normally used for conventional electric ranges and water heaters

Do-It-Yourself Solder

Swif, a solder with flux in paste form is designed for the home handyman—or handywoman—in do-it-yourself jobs For most jobs, separate cleaning tools usually required in soldering are eliminated

The solder is applied in paste form from a plastic squeeze tube to the s face to be soldered. The adjacent faces are then heated For small j such as soldering wires or small

of jewelry, the heat from an ordinary match or cigarette lighter directly on the solder is sufficient. For larger jobs the use of a torch or electric iron is recommended

Swif is a product of the Hercules Chemical Co of New York City.

Tomato Powder

You may be buying tomato juice by the bag soon.

High-quality tomato powder, which can be mixed with water to make a delicious tomato juice, can be produced by a continuous process in commercial vacuum-drying equipment, the U. S. Department of Agriculture, cooperating with the Chain Belt Co of Milwaukee, has found.

The Army Quartermaster Corps is testing the tomato powder made by the continuous-process method for possible military use. It needs no refrigeration and is very light in weight.

To make the powder, first the juice is concentrated by removing part of the water. The concentrate is dried in thin layers under special temperatures and pressures. The resulting powder is then ground up and packaged in a dry atmosphere, with addition of a drying agent to keep taking away moisture even after packaging.

From big juicy tomatoes, the final powder contains only up to 2 percent moisture.

Can't Burn Food on Experimental Stove

Kitchen stoves are going to have sense built into them so that foods cooking on top of the stove will not burn while the cook is answering the door or telephone.

The sense will come from a "sensing" element built into the center of the burner or heating unit. It will touch the bottom of the cooking utensil and sense the temperature of the food, automatically regulating the amount of heat required; thus making possible the cooking of even very delicate foods without danger of scorching.

This future development now apparently being tested was reported by Mrs. Pauline Treisch of the Tappan St Co. at a meeting of the American Home Economics Association.

Photoprints on Aluminum

For the home camera fan who desires something different in photographic reproduction, pre-sensitized aluminum sheets are available from the Metalphoto Corp., Cleveland, Ohio Photographs, drawings, etc., are developed directly onto these sheets, from ordinary photographic negatives, in the same manner as on regular printing paper. Standard darkroom techniques and solutions are used.

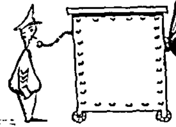
The film negative is reproduced on the Metalphoto plate by exposure in a contact-printing box or enlarger.

Unusual possibilities exist, color-wise. Plates may be immersed in various dye solutions. Still other interesting applications are possible with finished Metalphoto plates. Because they may be easily formed, they can be easily transformed into coasters, ash trays, etc.

Window Tightener

A window balancer and tightener that does away with the job of replacing broken sash cords is made by C. R. Vogts and Co., Inc., Moline, Ill. Fully adjustable after installation the device can balance any windows of any weight or be adjusted for swelling or warping of the sash. Plated against rust, the balancer is designed to be installed by the homemaker.

Louder Loudspeaker



When the conditions are right, a shout can be heard several hundred yards away. With a loudspeaker the distance can be increased to half a mile or so. This is not good enough for the Signal Corps of the United States Army. Accordingly, it has commissioned the Stanford Research Institute, Menlo Park, Calif., to produce something better.

The Institute is now working on what it calls the Stanford Airstream Modulator, or SAM for short The principle of SAM is easy to grasp. A stream of compressed air rushes out of an opening when a valve is opened by an amplifier. The stream makes no sound itself But speak into a horn and it is "modulated." In other words, it is cut up into impulses of different lengths, depending on the words, and the waves vary in shape and height. Speech is heard. This modification of the stream is called "modulation."

SAM works pretty much as we do when we talk. Our lungs and bronchia have a counterpart in SAM's compressor and airpipes; the vocal chords and larynx perform much the same function as do the valve and the container; the central nervous system controls the process of modulation much as do the amplifier; the mouth is the equivalent of the horn.

SAM can yell so loud that the engineers who experiment with it have to protect their ears with absorbing devices. In actual practice the voice is so loud that it can be heard four miles away, if the weather is right.

SAM is wanted when the human voice is likely to be more effective than field telephones or any other means of electrical communication. In World War II, and in Korea, loudspeakers were used with good effect to influence enemy troops, to direct our own naval craft and land forces. Radio equipment can be jammed. But not SAM There is nothing like direct communication in some situations. Hence the bull voice of SAM.

—*Waldemar Kaempffert in The New York Times*

Tornadoes and the spiraling whirlwind often accompanying intense forest fires have been made in miniature in a laboratory box. James E. Miller, professor of meteorology in New York University's college of engineering, reports his experiments with the weather model in *Weatherwise*, publication of the American Meteorological Society.

A shallow pan of water fits in the center of a circular box about two and a half feet across. A roof fan draws air from the chamber.

To make a model tornado, the water is heated, then fresh air is blown through two vertical slits in the wall so that the air spins around the center. Steam from the pan begins to rotate slowly, and suddenly forms a sharply defined verical column an inch or two in diameter, with a hollow core.

Wisps of steam at the column's edge spiral upward quickly. Water in the pan bulges up a half inch or so in a miniature waterspout, and droplets are thrown violently outward.

To make the fire whirlwind, a can of Sterno, "canned heat," replaces the pan of water. Soon after the Sterno is lighted and the blower turned on full force, a circular column of flame roars upward about 18 inches

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Patients Who Drive Doctors Crazy

by Dr. Keith Hammond

Condensed from Parade

DOCTORS should do no wrong That is the feeling of people everywhere—and from time to time doctors are called on the carpet, publicly or privately, because they are supposed to have "done wrong" Fees, services, hospital care, all have produced their share of criticism As a result, doctors have done a good deal of soul-searching through the years.

However, we also have come to *realize that our profession often is stung by half-truths, innuendoes and* outright falsehoods. We would not be human if we did not at least sometimes *think* of some of the shortcomings of our critics—our patients.

Let's consider some of these shortcomings as I see them in my daily practice I have placed them in ten categories—not in malice, or to point the finger at specific individuals, but in the belief that enlightenment breeds good will, and good will, in turn can result in better doctor-patient relationships. Here are the ten:

THE ALARMIST

To this patient every illness is an emergency—and the doctor " come quick." Ridiculous as it sound, I was once called at A.M. by an anxious husband his wife because of a

Parade (July 31, '55), 405 Lexington Ave., New York 17, N. Y. Copyright 1955 by Parade Publications, Inc.

had bothered her for some two years.

Before panicking, remember: there are very few real emergencies. Few sudden illnesses require immediate treatment. A few hours usually makes little difference. This does not mean to underestimate your symptoms. It means to contact the doctor calmly, tell him the facts and let him take it from there.

THE TIME-WASTER

Here is another disturbance to whatever peace there may be in the life of the physician. Asked how his appetite is, the time-waster recites—to the calorie—every item in his menu for the past week. Efforts to get his family history lead to long-winded expositions concerning cousins, aunts by marriage and family skeletons.

Time and service are all the doctor sells. Each 15-minute period in his day is worth just so much. If *he* wants to waste time in small talk, let him do it. Otherwise, stick to the business at hand—that of trying to find out what's wrong with you.

THE "SHY MAIDEN"

This is the patient, usually a woman, who is modest almost to the point of vulgarity. On the beach, *she thinks nothing of exposing her*self quite a bit. But in the doctor's office it's different: she considers herself ready for a complete examination after removing little more than her gloves and chewing gum.

To this patient I can only say: relax and let the doctor do his job. Let him feel for your spleen as well as your pulse. Let him use his stethoscope to listen to the "one-two" of your heart on your bare skin. It's all for your benefit.

THE "NO-PAYER"

One of my patients bends his elbow daily for a shot or more of old-fashioned "penicillin" at 60 cents a throw. By state law, that merchandise is strictly cash across the bar.

Yet this same man has a dog-eared card in my account files. On it are charges for many shots of the new penicillin for sore throats long ago cured and forgotten—along with the bills.

The air is filled with cries of "high fees," but many of us have relatively low fees in these days of inflated costs. Still, it is often a chore to collect. A 75-percent "take" marks the lucky doctor as practically as a financial giant.

Very few of us turn down a patient because of his lack of money. Still, we don't like to be taken for suckers when it comes to contributing to the public weal. Doctors are supposed to be loaded with legal tender. But let me assure you that, with many of us, our mortgages are the only thing big about our financial affairs.

Doctor Keith Hammond practices in a small Indiana community (Paoli, population 2,500), but he believes the patients he describes can be found anywhere in the U. S.

THE "I KNOW BETTER" PATIENT

Perhaps no one arouses the doctor to such an extent as the patient who diagnoses himself. He tells the doctor what's wrong and demands treatment. A mother's concern for her child may become exaggerated and lead her into this category.

So if you would stay in the good graces of your doctor, flatter him by letting him take the first crack at making the diagnosis

THE STUBBORN ONE

Many a doctor-patient relationship has been strained by the patient who insists on being "worked in" when the office is already filled with high-priority appointments Living the Golden Rule would relieve this blight

Remember, there's enough work to make any doctor's organized day a nightmare of disorganized bedlam. And this is not his fault—it's just the way things are.

THE NON-COOPERATOR

Perhaps nothing is more irritating to the doctor than the patient under treatment who fails to follow one word of the doctor's advice.

A doctor is making progress if his heavy-smoking ulcer patient cuts down from two packs a day to one. But if the patient fails to cut down at all, I sometimes feel like giving up and saying, "Why fight it?"

If you don't intend to follow his advice, there is no need to see a doctor.

THE WORRY-WART

To this patient every blemish represents a potential cancer, every chest pain is "certainly" heart trouble.

For your peace of mind, accept your doctor's advice and reassurance. Remember, it is normal to be concerned about your health, but needless worries can become a form of self-torture.

THE SHOPPER

If you want to put the doctor in a really bad mood, just greet him with a story about having seen lots of other doctors before giving him a whirl. Once, a woman graciously informed me that I was the 26th doctor she had seen in a year.

Such shopping around does the patient far more harm than good. It often represents a tragic desire on his part to get some doctor to tell him only what he wants to hear.

THOSE WITHOUT TRUST

Finally, there are people who do not trust doctors. Medical files are full of such cases. I know a middle-aged man who died needlessly of peritonitis following a ruptured appendix. He left his family destitute.

How many times have you heard: "Doctors operate whether you need it or not"?

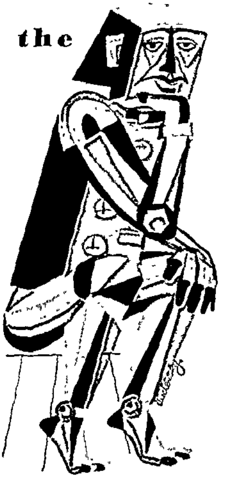
True, mistakes have been made. But the average doctor does *not* risk the life of a patient by submitting him to dangerous treatment—surgical or any other kind

the THINKER

high-school robot

by Jim Collison

Condensed from Popular Mechanics



AN ELECTRONIC THINKER—a completely mechanical robot—built by Robert Kotsmith, 16, and Michael Chmielewski, 17, high-school juniors at Foley, Minn., is passing exams of a factual nature that would stump any uneducated robot.

The machine, built during a period of ten months at an estimated cost of only $120, understands and answers the human voice. The Thinker answers mathematical questions, gives data on current events and history, writes, and even learns new facts.

Even to persons well versed on scientific progress, this project seems astounding. Foley's science instructor Alfred A. Lease says this of his students: "Their accomplishments would make some college graduates look on with envy."

When I walked into the chemistry laboratory of Foley High School, Lease and the two inventors were putting the Thinker through its trial performance. It had just written its first word: M-A-R-C-H. This was the month in which it was completed. As I walked in, the machine was writing L-E-A-S-E, clearly, in nearly square letters, slanted slightly left, about an inch high.

"Ask it any question you like," suggested the students.

The machine has three units. The main compartment, about 6 feet long, 3 feet wide and 4 feet high, contains the "brain;" the second unit holds the counting and spelling mechanisms, and the third houses the writing apparatus.

On the central brain unit are five switches and five warning lights to indicate which switch is on. These switches control the areas in which questions can be asked. Cube-root and square-root answers, each controlled from a separate switch, are given on the numbered unit. There is a switch for longhand writing and one for answering current events. The fifth switch directs multiplication answers

On the number-letter unit, one dial points to numbers 0 to 9, to a period, and to Yes and No Another dial points to the letters A to W. The mathematical answers are given through this unit along with answers that are spelled out In the writing unit a pen, hovering over a stack of paper, is held and directed by two metal "seesaw" fingers

I asked the machine for the square root of 98. (In asking questions through a microphone worn about the neck, each inquiry must be prefaced with "Now . .")

"Now . ." Lease ordered, "give me the square root of 98" As he said this he pronounced the words distinctly and counted on his fingers Pronounciation must be clear and syllables counted since inquiries must be limited to ten syllables

Slowly the number dial pointed out the answer. First to 9 Then to the period. Next the dial moved back to 9. That was the correct answer, 9 9. I asked for the square root of 177. Again, the correct answer: 13 3 All these answers had been "pumped" into the Thinker in a briefing session before I started my "interview."

I turned to current events "Now . president after Harry Truman." Slowly it spelled out E-I-S-E-N-H-O-W-E-R. I asked for the governor of Minnesota. It paused a few seconds—about ten seconds are needed between the answers—and wrote in those peculiar "drawn" letters, F-R-E-E-M-A-N. Correct.

That's remarkable for current events, I thought, but how would it do on history? I led off with, "Now . who won the World's Series last year?" That was too easy. It quickly answered, G-I-A-N-T-S I decided to go back a few years and asked the robot, "Now . . who was president after Monroe?" The machine wrote in distinct letters, A-D-A-M-S

Can the machine reason? A simple test showed that it will not. I asked, "Now . will Red China attack Formosa?" No answer.

The final question during this first 20-minute "run" surprised me As a special treat for me the boys had "briefed" it "Now . " they asked proudly, "name the represented magazine" Placing one word over the other, it wrote, P-O-P-U-L-A-R M-A-C-H-A-N-I-C-S.

They immediately noticed the error, and looked embarrassed. "Mechanics" was spelled wrong

So the machine could make a mistake, I thought But no, it was a mistake in briefing the Thinker, not the Thinker's error The machine spells phonetically After they told it to spell "mEchanics" the was correct.

Neither Lease nor tell exactly how the

tions. The "magic brain" is still under wraps because of possibilities of patents. This much of an explanation is given:

First, the Thinker is a facsimile type of machine. It reproduces answers given to it, but can't think for itself.

An audible word, signal or sentence is spoken into the mike and is carried to the central "nervous system" or "brain." Here the question is acted upon and answered by relaying electrical impulses over wires to a receiving apparatus which changes the impulses back into intelligible answers.

It does not involve anything basically original. Lease, who advised the boys, stressed that "we make absolutely no claims of discovering any new scientific phenomena."

It is unique because it applies old principles in a completely new and different way, according to Lease. He explained it this way:

"A professor once told me the only difference between an engineer and anyone else is that what takes others 100 hours to do, an engineer can do in 1 hour. About the same thing is the case here."

The machine's parts — mostly scraps—are worth about $120. The boys estimate their actual labor at 560 hours each. At a dollar an hour the total cost would run a little over $1,000. It's powered by regular household current, and uses about 200 watts.

The Thinker is built largely around the molecular theory of magnetism, the electromagnetic theory and the theory of electromagnetic induction. In other words, it is as simple as the common bar magnet, the electric motor, the electric generator and the transformer. It deals with inductance and inductive reactance, as applied in pulsating direct-current and alternating-current circuits.

The inventors emphasize that it is a completely "closed circuit" device, using no form of radio-type transmitter or receiver. The machine was originally designed to be a communications device rather than a question-and-answer-type machine. Its biggest value would be as a communicator, the boys believe.

• • •

As a novelty—leaving the Thinker in the back room for a moment—Castor the Great steals the show. He's a handsome, romantic and "dangerous" robot who roams the halls of Foley High School. Directing Castor on his jaunts is his creator, Kenneth Freude, 17, a junior.

After working for two months assembling various pinball-machine parts and other pieces of "junk," Kenneth was able to make Castor walk, defend himself with a water gun, pick up paper, wink at girls, talk and react with fright by raising his hair! Total value of this project—about $200.

There is also a little robot. Versal Cross, 17, the senior student who built it calls it a Doodlebug or *Snail*. The Snail follows a beam of light and, having lost it, searches until it finds the light again. It is not controlled by radio or by other remote controls. Assembled, it looks like a giant bug

with feelers guiding it as it searches for the beam of light.

Armies of the future might use cannons like the one Edward Heintze constructed as his science project. Loaded with water and a few drops of sulfuric acid, the cannon breaks the solution into gases. The gases are ignited by an electrical charge. With a loud "crack," the cork is sent sailing across the 40-foot classroom.

For a more recreational project, seniors Thomas Wildman and Gordon Viste, both 17, connected an "electronic brain" to an electric train A spoken command causes the train to stop, go forward or back up. The brain changes the sound waves of the voice into electrical currents. These are sent to the controls of a regular electric-train set One "shot" of electricity stops the train, two shots make it back up and three shots cause it to move forward. When a series of syllables is said—either one, two or three—the same number of electrical shots enter the controls and move the train.

The train works just like an old Iron Horse, too. Using "whoa" for the one-syllable command, the train stops. "Get-e-up" will make it lunge forward. "Back, boy" starts the train on a backward run.

In every corner of this Foley classroom are student-built machines that perform a variety of tasks. Each student must work on one project a year.

Lease, who taught shop classes for two years before becoming science instructor last year, says, "I will feel lucky if my efforts help produce only a handful of scientists, for even this handful may be responsible in the end for keeping our country in the scientific lead."

Straps and Pads for Auto Safety

Adding an energy-absorbing pad to the front end of automobiles and strapping drivers and passengers down with safety belts may save thousands of lives, according to Prof Elmer F Bruhn of the Purdue University School of Aeronautical Engineering

Professor Bruhn, an authority on airplane structure, has started studies of what happens when cars crash High-speed movies of crashes with model cars and dummy passengers reveal that being thrown forward when the car stops suddenly accounts for most crash injuries and deaths

An energy-absorbing device on the front end of automobiles to control crash deceleration, and restraining belts to keep drivers and passengers from flying into the car structure would provide a sufficient margin of safety when crashes do occur, Prof Bruhn believes.

Purdue's fleet of automobiles, used by staff members on university business, may soon sprout such safety devices, to test driver reaction to them, and, in case of any crashes, to check their effectiveness in decreasing injury.

Professor Bruhn also hopes to be able to stage real crashes with late model cars and volunteer drivers, in to demonstrate conclusively that safety devices he recommends will effectively in cars, as they do in r

A B C's OF TRAVEL IN SPACE

Condensed from U S. News & World Report

> Is The Day *of space flights just around the corner, now that the U.S. is planning to send an artificial satellite spinning around the earth, outside the atmosphere?*
>
> *What is it like out there? Could a man survive? Can scientists really do this? And, if they succeed, what good will it do?*
>
> *In this interview, three scientists who are leaders in the satellite project give the answers.*
>
> *Doctor Alan T. Waterman is director of the National Science Foundation, Dr. Alan H. Shapley is vice-chairman, and Dr. Athelstan F Spilhaus is a member of the U.S. Committee for the International Geophysical Year.*

Q. CAN YOU EXPLAIN for us, just what is this so-called man-made satellite that the U. S. is going to build?

A Well, to put it briefly, the satellite is a small metal object that is going to be projected out about 200 or 300 miles into space and then sent spinning around the earth at speeds of around 18,000 miles an hour. It may be equipped with electronic instruments to report what it finds out there and send those reports back to us here on the earth.

Q. This sounds like Buck Rogers or Jules Verne. Is it really the begi ning of space travel? Is man actual going to be able to fly to the mo or maybe to Mars?

A. We're not buying any spa helmets.

Q. Isn't it a step in that directio

A. This is a normal, small step seems like a terrific step, but it is ju the next in a series of experiment

Q. Couldn't this satellite lead some of these Buck Rogers types things that people speculate abo such as a big landing-platform, way-station, circling out in spac and eventually to flights to the mo or Mars?

A. It is possible—but we have know more about a lot of things b fore we can say. We can do it onl systematically, step by step.

Q. What is the next step?

A. The next step might be to se if you can shoot one of these littl satellites out and make it go roun the moon

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Q. What would happen to a ma out there in space?

U S News & World Report (Aug 12, '55); 24th & N Sts, N W, Washington 7, D C Copyright 1955 by United States News Publishing Corp

A. He would be burned up by the heat or he would explode because of the vacuum.

Q So you think it's still going to be quite a while before man can fly to the moon?

A Yes, that's a long way off.

Q. The first reaction of a lot of people to this satellite announcement was a kind of fright. People read a military meaning into it, seemed to think it had something to do with war. Is there really any reason to be frightened?

A. I should certainly think not.

Q. What is the purpose of this satellite?

A. The purpose is to find out much more than we know now about conditions outside the earth's atmosphere.

Q What is it that you want to learn about outer space?

A. Oh, all sorts of things. We want to know more about cosmic rays, how the sun creates the ionosphere, about the stars, temperatures, densities—many things like that.

Q. Could you give us some examples of how this research might affect our daily life?

A For one example, interruptions in our transatlantic radio communications are caused quite directly by radiations from the sun that disrupt the ionosphere—the electrified upper layer of the atmosphere. You see, the sun has direct influence on whether or not you can talk to Paris The whole radio-communication industry is based on the use of the atmosphere.

Or take meteorology, for example—weather forecasting. Each country has done some work in weather observation, but it is very spotty. We don't get anything at all from the whole antarctic region, and we know that there are events occurring there that affect the weather of the whole world.

We have actually reached the stage where we can't improve our weather forecasting much until we can get world-wide information, including especially the polar regions. We are now stymied.

Q. Then you think the studies planned with this satellite would improve our weather forecasting?

A. Yes. You see, there's the sun out there behaving like a boiling kettle that erupts every once in a while and does all sorts of things to us If we knew what that is, what it does to the outer air—once we can get the general pattern from all over the world—then this thing will become a rational pattern. It will lead ultimately to an improvement of our understanding of weather and climate, and will enable us eventually to make better forecasts

Q. Haven't we sent rockets up about as high as this satellite will go, and haven't these rockets sent back a lot of information about conditions out there?

A Yes. Our scientists have done a very clever job in instrumenting rockets. They make observations and send radio signals down But a rocket is up there only momentarily It just goes up and drops again If yo can get something up there that stay there, then you'll know things are changing.

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Q. What is the next step?

A. The next step might be to see if you can shoot one of these little satellites out and make it go round the moon.

Q. How about shooting people out into space?

A. We are not talking about people at all—yet Before we start going outside the atmosphere ourselves, we'd better find out if this little satellite can do it.

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WHY U. S. SHARES FACTS

Q. What will be done with all this information that is gathered by the satellites? Will the U. S. share it with the rest of the world?

A. Yes. You see, the launching of the satellite is being done as part of the program of research set up for the International Geophysical Year of 1957-58. Forty countries are involved in this. Most of the countries of the world except China are already participating in the research program.

Q. Will all of this information then be exchanged?

A. All of this information will go to a number of central clearing houses for the various fields of research.

Q. Are the Rusisans taking part in this Geophysical Year?

A. Yes.

Q. The Russians have indicated that they were thinking

going to be put in the satellite that America is planning. Does this mean that Russia is already ahead of us on this thing?

A. There's nothing wrong with speculation. What they were saying has been said and written in this country many times. Any scientist could report the same thing

Q. You say this satellite will have no direct military use, but will it give us information that will be useful militarily as well as scientifically?

A. Well, it would be of use militarily in so far as finding out conditions in the upper air for air flight and communications.

Q. Would it help with guided missiles?

A. Yes, to the extent that guided missiles travel through the atmosphere and it is necessary to have some idea of what they are likely to *encounter.*

WHAT'S OUT IN SPACE

Q. What is this satellite going to run into out there in space? What will it be like?

A. Absolute silence, for one thing. The sky would be black, the stars would be very bright, the sun would be terrifically intense.

Q. What kind of temperature will it find?

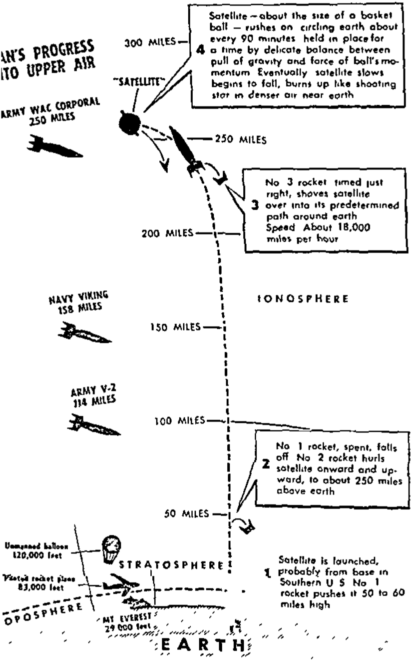
A. The sun up there is terrifically hot, but we don't know just how hot this satellite will get. It depends on many things. For instance, color is an important factor in the reflection or absorption of the sun's powerful rays.

Q. But doesn't it get colder as you get higher?

A. We've improved our idea of what the temperature is like out there. Before the rockets began this exploration, everyone thought that the temperature fell off as you reached a high point, and went to about 70 degrees below zero Fahrenheit. Now we know that's all wrong. The temperature goes down to a low point and then comes up high, and then goes through alternately cold and hot layers.

Q. Will there be any living thing

HOW "SATELLITE" WILL WORK



put in this satellite—such as a mouse or an insect?

A. I would hardly say so, for the first time.

Q. But later on, maybe?

A. If it works, and we can develop it further, that would be one of the steps. Another thing would be putting in some germinating seeds to see if the cosmic rays do things to them. But that involves getting those things back on earth again

PROBLEMS FOR SPACESHIPS

Q. Then, from what you say, aren't we still a long way from a spaceship in which man could travel into outer space?

A. Before anyone could contemplate going out into space, there is the question of how people would react physically. For example, out there, things have no weight. When you try to pour a glass of water, the water won't pour, it will just stay where it is. Nothing is anchored to anything, but just moves freely. Our bodies did not develop in that kind of environment. Blood circulation, swallowing, all our movements are regulated to the feeling of gravity. Could people stand such a change indefinitely?

Q. Couldn't you use a pressurized cabin?

A. That wouldn't solve this situation This is an absence of gravity. For instance, if this room were out on a spaceship, you couldn't walk. When you pushed against the floor you'd go up to the ceiling.

Q. What other problems would man encounter in his flight in space?

A. There are lots of problems One of the problems in space travel is the density of these little meteorite swarms in outer space. You see, when these things hit the atmosphere they burn up. They are tiny little things only as big as a pinhead.

Q. Are these the shooting stars we see?

A. Well, the brightest shooting stars may be larger. But there may be swarms of these things out there Naturally, if you hit a swarm of these things at 18,000 miles an hour it would be terrific.

Q. Do you have any assurance that these meteorites won't destroy the satellite?

A. Well, of course if they are there in that density, that will be an extremely valuable piece of information in itself. But these are some of the terrific unknowns.

Q. Has this satellite been designed yet?

A. I can say that we know we can do it. Rockets have already been up there. So it's only a matter of perfecting it. But actual specifications have not been worked out yet.

Q. What will it look like?

A. It will probably be round, to reduce friction, and it will be about the size of a basketball, I guess.

Q. How much would it weigh?

A. If it's light, it's easier to get up there. Of course, the heavier we can make it, the more instruments we can put in it.

Q. What kind of instruments do you plan to put in it?

A. Instruments to make and re-

port the various measurements that we want to take. As the instruments make their observations, they will send the report back by radio signals.

Q. But it can't take pictures and send them back to earth?

A. No. Not now, at least

Q. After you get this satellite up there, what keeps it moving in a circle around the earth?

A. There's nothing to stop it. Ordinarily, you see, things are stopped because of the friction of the air. But up at that height there is no air—or almost none So, with no friction to slow it down, the satellite will just keep going.

Q. Indefinitely?

A No, because there is still a little bit of air at that altitude So the satellite will spiral in gradually But we hope it will stay up for several days, at least

HOW GRAVITY HELPS

Q What holds it on its course around the earth? Gravity?

A. Yes, gravity—the pull of the mass of the earth—is always pulling it down But, like anything moving in a circle, centrifugal force is also pushing it out At any given distance and speed, these things balance What you do is balance the two forces, and then it goes in a circle, traveling constantly at the same distance from the center of the earth—or almost Probably its course will be slightly elliptical, just like the earth's orbit around the sun.

Q. How will you get the satellite up to the necessary height?

A. It already has been done. Remember those high-altitude rockets?

Q. How high have they gone?

A. The highest is 250 miles.

Q. Well, if you know the shape of this satellite, and you know the instruments that you want to put into it, and you already know how to get a rocket up 250 miles, what's the remaining problem?

A. This satellite not only has to be put up there, as far as the rockets have gone, but it then has to be started off in a new direction—paralleling the earth—at a speed of 18,000 miles an hour, or 5 miles a second.

Q How will you do this?

A. One way is to have the rocket go straight up 250 miles and then shoot the satellite out horizontally It may be more economical to have the rocket go up on some kind of a curved path and at the top accelerate while going in the right direction We may have to find something in between But that's the problem—to get the thing going up there in the right direction at this whopping speed so it will stay in the desired orbit

Q Do you know whether you can attain such speed?

A Yes, we think we can. That's why we made the announcement

Q How do you propel an object out there in space?

A. Well, you have to have a stream of hot gases coming out -hind which makes the thing, ward When you are in a place there's no air, you can't get from the air

Q. What do you

put in this satellite—such as a mouse or an insect?

A. I would hardly say so, for the first time

Q. But later on, maybe?

A. If it works, and we can develop it further, that would be one of the steps. Another thing would be putting in some germinating seeds to see if the cosmic rays do things to them. But that involves getting those things back on earth again.

PROBLEMS FOR SPACESHIPS

Q. Then, from what you say, aren't we still a long way from a spaceship in which man could travel into outer space?

A. Before anyone could contemplate going out into space, there is the question of how people would react physically. For example, out there, things have no weight. When you try to pour a glass of water, the water won't pour, it will just stay where it is Nothing is anchored to anything, but just moves freely. Our bodies did not develop in that kind of environment. Blood circulation, swallowing, all our movements are regulated to the feeling of gravity. Could people stand such a change indefinitely?

Q. Couldn't you use a pressurized cabin?

A. That wouldn't solve this situation. This is an absence of gravity. For instance, if this room were out on a spaceship, you couldn't walk. When you pushed against the floor you'd go up to the ceiling.

Q What other problems would man encounter in his flight in space?

A. There are lots of problems One of the problems in space travel is the density of these little meteorite swarms in outer space. You see, when these things hit the atmosphere they burn up They are tiny little things only as big as a pinhead.

Q. Are these the shooting stars we see?

A. Well, the brightest shooting stars may be larger. But there may be swarms of these things out there. Naturally, if you hit a swarm of these things at 18,000 miles an hour it would be terrific.

Q. Do you have any assurance that these meteorites won't destroy the satellite?

A. Well, of course if they are there in that density, that will be an extremely valuable piece of information in itself. But these are some of the terrific unknowns.

Q Has this satellite been designed yet?

A I can say that we know we can do it. Rockets have already been up there. So it's only a matter of perfecting it. But actual specifications have not been worked out yet

Q. What will it look like?

A. It will probably be round, to reduce friction, and it will be about the size of a basketball, I guess

Q How much would it weigh?

A. If it's light, it's easier to get up there. Of course, the heavier we can make it, the more instruments we can put in it.

Q. What kind of instruments do you plan to put in it?

A. Instruments to make and re-

-port the various measurements that -we want to take. As the instruments ake their observations, they will :nd the report back by radio signals.

Q. But it can't take pictures and :nd them back to earth?

A. No. Not now, at least

Q. After you get this satellite up here, what keeps it moving in a ircle around the earth?

A. There's nothing to stop it. Ordinarily, you see, things are stopped ecause of the friction of the air. But p at that height there is no air—or lmost none So, with no friction to low it down, the satellite will just :eep going

Q. Indefinitely?

A No, because there is still a little bit of air at that altitude So the sat-:llite will spiral in gradually But we hope it will stay up for several days, at least.

HOW GRAVITY HELPS

Q. What holds it on its course around the earth? Gravity?

A Yes, gravity—the pull of the mass of the earth—is always pulling it down But, like anything moving in a circle, centrifugal force is also pushing it out At any given distance and speed, these things balance What you do is balance the two forces, and then it goes in a circle, traveling constantly at the same distance from the center of the earth—or almost. Probably its course will be slightly elliptical, just like the earth's orbit around the sun

Q. How will you get the satellite up to the necessary height?

A. It already has been done Remember those high-altitude rockets?

Q. How high have they gone?

A. The highest is 250 miles.

Q. Well, if you know the shape of this satellite, and you know the instruments that you want to put into it, and you already know how to get a rocket up 250 miles, what's the remaining problem?

A. This satellite not only has to be put up there, as far as the rockets have gone, but it then has to be started off in a new direction—paralleling the earth—at a speed of 18,000 miles an hour, or 5 miles a second.

Q. How will you do this?

A One way is to have the rocket go straight up 250 miles and then shoot the satellite out horizontally. It may be more economical to have the rocket go up on some kind of a curved path and at the top accelerate while going in the right direction We may have to find something in between But that's the problem—to get the thing going up there in the right direction at this whopping speed so it will stay in the desired orbit

Q Do you know whether you can attain such speed?

A Yes, we think we can That's why we made the announcement

Q How do you propel an object out there in space?

A Well, you have to have a stream of hot gases coming out behind which makes the thing go forward When you are in a place wher there's no air, you can't get any pus from the air.

Q What you push agai

then, to obtain your momentum?

A. You don't push against anything. You throw away a mass behind you, and the reaction is that you go forward There was an example they used in my school days: How would a fellow without any atmosphere about him get off a perfectly smooth table? The answer was that you'd take off your boot and throw it away from you and you would fly off in the opposite direction. Or it's like two ice skaters: When they push against each other, they glide off in opposite directions.

Q. You say you expect the satellite to come down after a few days. Will it return to earth and be recovered?

A. No. You see, it will be traveling at such terrific speed that when it hits the earth's atmosphere, where there is friction, it will burn up—like a meteor.

Q. Why won't it burn up on the way up?

A. We won't allow it to go so fast on the way up. It attains that 18,000-mile speed after it leaves most of the atmosphere.

SPOTTING SATELLITE IN SKY

Q. The statement has been made that we will be able to see this satellite as it circles the earth. How can we see something the size of a basketball that's 200 or 300 miles away?

A. It depends upon how fast it is moving and how the sun hits it. Actually, of course, the statement that it will be visible to the naked eye should be qualified. I think the best estimate is that, if you knew just where it was, you might be able to see it without a telescope, but the problem of finding just where it is at such speed is tremendous After all, it will be traveling horizon to horizon in about three quarters of an hour. But the astronomers are convinced that you will be able to see it quite easily with binoculars

Q. But you aren't going to be able to walk along the street, look up and see it, rather casually, are you?

A. No, not with the naked eye If you have ever had a chance to watch any of these weather balloons go up, you can see one of them for a long time if the sun is shining on it and if you keep looking at it. But the instant you look away you have trouble because you don't know where to look back to. You lose it very quickly unless you keep watching it. It's that kind of thing.

Q. The most you could expect to see would be a tiny speck of light?

A. That's about all.

Q. Would this satellite look like a flying saucer to a man in an airplane?

A. I don't know. What does a flying saucer look like?

THE first internal combustion engine exploded gunpowder fuel in its cylinders.

• • •

POWER can now be produced from the sun's rays, but at from three to five times the cost of producing it from ordinary fuels.

BUBBLES THAT TRACK ATOMS

Condensed from the University of Chicago Magazine

In a tiny glass chamber measuring one inch in diameter by four inches in length, physicists may solve some of the basic laws governing the fundamental particles of which all matter is composed

Exploring the mysteries of the atomic world in a minute hydrogen "bubble chamber" are Drs Roger H Hildebrand and Darragh E Nagle, assistant professors in the department of physics at the University of Chicago Both are also staff members of the Institute for Nuclear Studies.

Physicists have for some time been attempting to identify particles and forces at play in the fantastic world of the nucleus, or core, of the atom These particles consist of electrons, protons, neutrons and several kinds of mesons, the smallest constituents of matter Scientists feel they have reached a kind of ultimate simplicity in the electron, but the structure of the proton, for example, must still be explored

Mesons, discovered just after the war, presumably have a great deal to do with nuclear forces Physicists think the meson plays a role in holding together the particles that make up the nucleus, but just how it performs this they have yet to discover

Scientists probe the nucleus by bombarding it with high-speed particles from cosmic rays, particle accelerators, and nuclear reactors.

When a nucleus is hit by a high-energy particle any of several things may happen: The particle may bounce off and leave the nucleus unchanged, it may break the nucleus into fragments, or it may give birth to entirely new particles.

Until recently, there have been two ways of observing and measuring these events: a cloud chamber or a photographic emulsion.

A cloud chamber consists of a box supersaturated with alcohol vapor, so it is on the verge of "raining" inside When a particle from a cosmic ray or other source is sent through, a row of tiny drops forms along its path showing exactly where it went.

There are limitations to this method, since in the low-density gas nuclear collisions are rare. Besides, after one particle has passed through, it takes a comparatively long time to clear the chamber for the ne event.

The second device used for rec ing nuclear events is a special p graphic emulsion, called a

University of Chicago Magazine (April '55), 5733 University Ave, Chicago 37, Ill Copyright 1955

emulsion. In going through a photographic emulsion a particle leaves a train of "exposed" silver grains on the photographic plate which shows up on development.

Because it is small and compact, a nuclear emulsion can be used in many places, and is sometimes sent into the upper atmosphere attached to balloons or rockets to study the primary cosmic radiation from outer space.

This method, too, has its limitations, since one can rarely trace the particle for more than a fraction of a millimeter through the emulsion and since the many different types of atoms in an emulsion often make it difficult to interpret the events which are recorded in the grains of darkened silver.

About two years ago, Dr. Donald Glaser of the University of Michigan began experimenting with a third method for viewing the paths of nuclear particles.

The gadget used in this method is called a bubble chamber, because a particle moving through the liquid in the chamber leaves a track of tiny bubbles in its wake. In principle the bubble chamber is somewhat like a pressure cooker since the liquid in it is heated above its normal boiling point under pressure. When the pressure is released the liquid is left in what is called a superheated state, which means that it will boil violently if disturbed in any way. In particular the boiling can be started by a nuclear particle passing through the chamber.

Small bubbles can be either photographed or seen by eye if a light is flashed a few thousandths of a second after a particle has passed by. At this time the bubbles will still be small and will lie in a row along the path of the particle so that they reveal its history in passing through the apparatus.

Encouraged by the success of Dr Glaser's invention, Hildebrand and Nagle decided to see whether a bubble chamber could be made using liquid hydrogen. (Dr. Glaser used ether.)

Their interest in hydrogen was due to the fact that a hydrogen nucleus is the simplest of all nuclei and gives the best chance of understanding what is seen.

The use of hydrogen introduced technical difficulties since hydrogen gas cannot be liquefied until it reaches a temperature of minus 460 degrees Fahrenheit. With the help of Dr. Lothar Meyer and Dr. Earl Long of the Low Temperature Laboratory at the Institute for Metals, Hildebrand and Nagle built the necessary apparatus.

Currently the most exciting experiment is a study of the behavior of negative mesons in hydrogen. It is known that a negative meson often changes its identity, becoming a neutral meson. This in turn decays after living an extremely short life, turning into gamma rays or electrons. The bubble tracks which will appear in the liquid hydrogen in these various events may help to explain the nature of this particle.

the magical sense of SMELL

by Will Bernard

Condensed from Today's Health

MAN has been fascinated by his nose ever since the dawn of story. He has pierced it to prevent il from stealing into his body, he as plugged it to prevent life from obing out. He has considered himlf lucky when it sneezed, unlucky hen it itched. He has carved it for eauty, painted it for courage. He as laughed over it, cried over it, elebrated it in song and story.

But only recently has he begun to gure out how the wonderful thing orks—how it performs the magic e call smelling. Science is just tarting to understand the fantastic ecoding system that tells you you're melling a rose and not a skunk.

• • •

Most of us think of smell as a econd-rater in the arsenal of the enses—a sort of junior partner to he sense of taste Yet the truth is just he other way around It's not your ongue but your nose that really avors your food When the aroma from a sizzling steak drifts into your nostrils, the work of your smelling apparatus is only beginning. Not until you've popped the meat into your mouth does smell come into full play.

As you chew, you release fumes of odor that rise through the back of your mouth into the inner recesses of your nose — where the olfactory nerve is located It's there that you discover the delights of a steak that is "done to a turn," or a lemon pie that is "scrumptious"

Your tongue tells you of only four basic flavors—sweet, salty, sour and bitter But your nose can distinguish tens of thousands of different flavors, and new ones are being discovered all the time.

When your nose isn't on the job, an onion and a ripe apple both taste the same—slightly sweetish, because that's all that the limited facilities of your tongue can tell you about them Ham, unsmelled, tastes lamb. The finest claret, unsm tastes like weak vinegar.

That's why gourmets eat —allowing plenty of time

Today's Health 535 N Dearborn St, Chicago 10, Ill

all-important fumes to caress their olfactory systems.

Up to a certain point, science knows pretty well how this sense operates. Your olfactory organ consists of two flat membranes, one in the upper portion of each nostril, and each about the size of a postage stamp. Sticking out of the membranes, like so many lines on a telephone switchboard, are tiny hairs. When the odor reaches these hairs, it sends electrical impulses racing along an intricate network of nerves to your brain. There the impulses "light up" a specific code which your brain translates into a sensation.

But a crucial link in this chain of events has long been a mystery. Exactly what happens at the point of contact? What touches off those telltale impulses? How does your sense of smell pick up the message?

Your ear receives the message of a sound by vibrations. Your eye receives the message of a sight by light waves. But no such simple explanation seems to fit all the known facts about the subtle sense of smell.

One theory after another has been put forward to clear up the enigma. And now evidence is mounting that your smelling equipment can receive odors in several ways, not just one.

Thus there is reason to believe that the damp film around your olfactory hairs can trap tiny particles, dissolve them and start off a chemical reaction—something like a glass of water setting off the fizz in a fizz-powder.

There is also evidence that your organ of smell is equipped with zigzag-shaped receptors which react by meshing with odorous molecules the same shape—much as a lock r acts by meshing with the right ke

Still other experiments indica that you can detect an individu odor by the special way it distur the fine enzyme balance of your o factory cells

By such complex means, and pe haps more, your receiving apparatu seems to gather in the signals fro the world of odor. With such tech niques we pick up the skunk's mes sage of dismay, the rose's message o delight, gas's message of warnin and an attic's lingering message o nostalgia.

It's small wonder that no scientis can yet claim to have all the answers. For your nose can receive, analyz and sort out odors with a speed an finesse that no laboratory instrumen can duplicate. When you notice th perfume of a girl you pass on th sidewalk, you are sensing an amoun of odor so infinitesimal that no me chanical device now known coulc either detect or record it. While it's true that a bloodhound can follow a spoor better than you can (partly because his nose is closer to the ground), your human sense of smell is definitely no slouch.

At top efficiency, your nose can probably detect as little as two trillionths of a gram of a strong-smelling chemical.

When King Tut's tomb was opened and ancient perfume flacons were found, the perfume had long since evaporated, but the noses of the cheologists could still detect faint aromas more than 3,000 years ol

It's a common belief that when conditions are right you can smell fright in another person. But some odor experts think that doesn't do justice to the nose's sensitivity. They believe you can even distinguish between different kinds of fright, to wit:

"Platform odor" — from a person nervously making a speech before a crowd;

"Ladder odor" — from a person perched precariously on the top of a ladder, and,

"Fear odor" — from the same person if he was chased up that ladder by an angry dog!

In fact, as far as we know now, there may be no limit to the number of smells the human nose can recognize. And since almost everything around us has some odor (usually more than one), your olfactory mechanism is obviously a busy crossroads.

Handling such a flood of sensations would be a lot harder if your nose didn't have a remarkable talent for adaptation. When an odor comes in strongly, you automatically "tune down the volume" by the process known as odor fatigue Smell a carnation. The first whiff is powerful, the second weaker, and pretty soon you can't even smell it at all. Thus the potent stench of the stockyards doesn't spoil the appetite of the men who work there—because their noses quickly learn to live with the smell, to make it "normal" instead of offensive.

People who live in cities where the water reeks of sulfur don't mind it at all, while out-of-town visitors turn thankfully to the distilled product of soft drinks to quench their thirst.

Unfortunately, this phenomenon of odor fatigue also blunts your awareness of your own breath and body odor. That's why Orientals can detect a "buttery" smell in Americans that we don't notice, and Americans can detect a "blubbery" smell in Eskimos that they are equally unaware of. That's also why a wise woman will ask her husband if she's wearing too much perfume, instead of relying on her own and possibly dulled perception.

• Smell is the most important part of the mystery of gastronomy, contributing as it does three quarters of all our delight in eating and far exceeding the rapture to be derived from taste alone

—Brillat-Savarin

Your olfactory organ also has an amazing degree of esthetic discrimination. A smell that your nose will relish in combination with the other odors of good cheese it will abhor in eggs. The odor of roast beef, delightful in the kitchen, outrages your nose when you smell it in a wildflower Civet and ambergris, essential elements of expensive perfumes, are horrendous on their own. The smell of a pipe, tantalizing in small quantities to a girl in love, may be hateful in large doses to a wife.

A strange quality of your nose, oft noted but little understood, is its uncanny partnership with memory. Even a casual smell can instan resurrect an experience from the past, sometimes most vividly.

A British psychologist got

startling results by plying a group of adults with selected odors — to see what memories he could evoke. One subject, smelling cedarwood oil, remembered his school days, apparently because of the cedarwood odor in pencils. Another, sniffing citronella, "heard" the high whine of mosquitoes. Musk sparked such diverse memories as cows, cathedrals and immorality. To one man, musk brought back the long-forgotten occasion when he first touched a girl's hand. Orris root recalled violets, tea, an old lady, and the smell of an elephant at a distance!

Another person, whiffing cassia oil, got a sharp visual image of a doctor long since dead. The psychologist suggested that such effects might well explain spiritualistic manifestations, if the odor-impregnated clothing of the deceased person were in the room during the seance.

Because it operates so stealthily, your sense of smell seldom gets full credit for what it does. Not only taste, but sound and touch and sight often hog the front of the state of consciousness, while smell does its work behind the scenes. The sound of singing birds is far more lovely when harmonized with the aroma of spring flowers. The touch of a girl's lips is more delightful when her hair is radiating a faint fragrance A sunset on the ocean would lose much of its beauty without the bracing tang of salt air.

Some years ago a group of women were asked to make a choice between two kinds of hose. Although they didn't know it, the stockings were exactly alike in every detail, except that one kind was faintly scented By a three-to-one ratio, they picked the hose with the fragrance.

Yet, when questioned as to their reasons for choosing, none mentioned the fragrance. Some, trusting their sense of touch, mentioned "texture" and "feel." Others, relying on their sense of sight, talked about "color" and "sheen." Not a single woman realized that she was led by her nose!

Even when you are aware of an odor, the power of association may step in and play tricks with your interpretation. Witness the wry results reported by the United States Bureau of Mines when, for testing purposes, it introduced a foul-smelling chemical into the gas mains of a certain community. One housewife bawled out her butcher for delivering spoiled meat. Another informed her husband that he needed a bath. Several persons got busy and ripped up floors in search of dead cats

The way a smell can ignite passion has been known, of course, to all the great temptresses of history. Shakespeare wrote that with Cleopatra's perfumes "the winds were love-sick," and Josephine kept her boudoir a heavily-scented haven for Napoleon. But nowadays we realize that your sense of smell can tell us a lot more than "Love that woman!" or "Admire that man!" Because of its far-reaching effect on our moods and emotions, it has been called "the shortest route into the subconscious"

The smell of your own home, when you return from a journey, can induce a sense of relaxation and well-being

fficiency experts have recommend- l pleasant odors to improve the orale in factories. Doctors are dis- ussing "odor therapy" for hospitals example: scenting the room of a outhern patient with the smell of oneysuckle, hot biscuits, or corn read).

In the field of selling, odor has be- ome big business. Sales-minded ompanies have discovered that the ght smell can touch off a buying rge not only for perfume but also or girdles and stationery and real state and coal and shoes. Smart nerchandisers now use not only price ppeal and eye appeal but also nose ppeal as well. Confectioners boost heir sales by putting a pleasant smell into the wrapper as well as the candy. Department stores use carefully-chosen fragrances to put customers in a spending frame of mind. Laundries add a faint scent to make your clothes smell fresh when you open your bundle Chemists are marketing a fantastic array of special-use aromas, including such exotic scents as "new-car smell" (to be sprayed on used cars).

While your sense of smell is winning new respect, it might also awaken growing envy in these days of political storm and strife For the world of olfaction is a world of perfect democracy To you, as to everyone else, the aromatic abundance lies open—yours for the smelling.

Young Men in the Sciences

"When were you at your mental prime?" It is the rare man indeed who will not answer: "I'm at my prime right now."

Hence, when recognition finally comes to the successful physicist, and a biographer requests a picture he invariably receives one of recent date Of course, before the popularity of photography, it was only a recognized success who was in possession of a likeness of himself. But even today, the pictures that adorn our textbooks and propose to inspire our students are too often those of dignified elderly gentlemen

The writer holds no prejudice against dignified elderly gentlemen; indeed, it is his ambition some day to become e. However, this custom of illustr textbooks and biographies with likeness made in advanced age has created a misconception in the minds of students The picture of a mature, bearded Galileo dropping objects from the Tower of Pisa belies the fact that his investigations on freely falling bodies were performed at the age of 27

The knowledge that so many important discoveries in physics have been made by young men comes as a surprise to most students—and a pleasant surprise Students never fail to look with new interest upon work done by a man at very nearly their own age Physics is revitalized in the minds of the s dents by the knowledge that it is a for *young* men—men like the

—*K. L. Yudowitc*
American Journal

Cat Hears High-Pitched Sounds Better than Man

A cat may not hear the deep rumble of a passing truck or thunder as well as a man can, but its hearing is much better when it comes to the high-pitched squeak of an insect or the chirp of a bird.

The span of the cat's hearing has been measured by Drs. William D. Neff and Joseph E. Hind of the Laboratories of Physiological Psychology and Otolaryngology at the University of Chicago and reported in the *Journal of the Acoustical Society of America.*

For frequencies below 500 cycles per second a cat's ears may not be as sensitive as man's. But actually, the lowest notes to which man is sensitive are felt rather than heard Frequencies below 20 per second are sometimes felt as vibrations on the body.

From 62 5 cycles per second to 2,000 the sensitivity of cats and men is pretty much the same. For frequencies higher than 2,000 the cat shows its superiority

Man hears his best between 2,000 and 4,000 cycles per second Beyond 4,000, his sensitivity rapidly drops and the upper limit is reached at about 20,000 cycles per second, which is the frequency of the highest notes of the violin.

A cat's hearing is at its best at about 8,000 cycles per second and its hearing is good up to 40,000 cycles per second. The upper limit is not reached until 60,000 cycles —*Science Service*

Predict Big Future for Photography

Photographic film speeds may increase as much as 100 times in the next 75 years, Donald McMaster, vice-president and general manager of the Eastman Kodak Co, said recently.

McMaster asserted that in the 115 years since the invention of the Daguerreotype the speed of the photographic system has already been increased about one million times. In predicting speeds which photographic materials will attain in the future, he pointed out that even the high-speed films currently available are not the ultimate

McMaster also made these additional predictions on future developments in the field of photography:

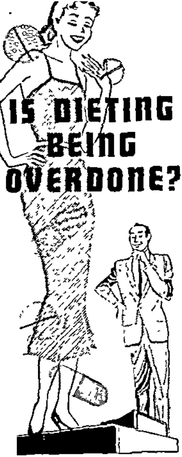
Film processing — both black-and-white and color — will become much simpler and quicker.

Color-picture quality will continue to improve, and color-film speeds will be faster.

Medical motion-picture radiography will become widely used as a tool for diagnosis by doctors.

New types of photosensitive materials will come into use, especially in the graphic arts field.

McMaster based his estimates on developments currently in the industrial research laboratories, on our photographic needs and wants, and on the present directions of technology.



IS DIETING BEING OVERDONE?

by Tom Mohoney

Condensed from
The American Legion Magazine

44-YEAR-OLD Detroit society wo-
. man lost her life, coincidentally
h bringing her weight down to
) pounds, on a diet principally of
'd-boiled eggs, pepper and raw
fee.

An East Orange, N.J., girl became
nvinced that she could digest only lemonade, ginger ale and an occasional lollipop. After a decade of this diet, she died. The cause of death was listed as chronic malnutrition.

Even if it isn't fatal, overdieting can have serious physical and emotional effects Besides making the subject hungry and irritable, starvation from overdieting may knock out the body's master gland, the pituitary, which influences the sex glands and many others.

The current weight-reducing craze has been aptly termed "the great American obsession." It was going strong under its own power and with the encouragement of the sellers of "health foods"—a term deplored by both the Food and Drug Administration and the American Medical Association—when Christian Dior, the Paris dressmaker, decreed the "long lean look " This made reducing frenziedly fashionable. (Since this article was written, Dior has modified the "lean look" for upcoming fashion)

A deluge of pronouncements that excess weight shortens life, also has enrolled millions of men in the ranks of the reducing.

Calories are the No 1 topic of conversation in bars, boudoirs and drawing rooms. Anybody who eats dessert is considered to be living dangerously.

Doctor Peter J. Steincrohn, the well-known writer-physician of Hartford, Conn , says: "The pendulum has swung over too far and dieting is often overdone to the ' ment of health and appearance.

What is it all about? What mean to you?

'he American Legion Magazine (Aug '55), 720
th Ave , New York 19, N Y Copyright 1955

First of all, there are a few things to be said in favor of weight and even fatness. For boys and girls and adults in their twenties, doctors generally agree a little extra weight does no harm. And being fat is not necessarily a calamity for older persons. Weighing 265 pounds did not keep Jackie Gleason from a $7 million television contract, the biggest in entertainment history. Tipping the scales at 320 pounds is freshman congressman from New Jersey, Rep. James Tumulty. Except for a little difficulty finding size-56 evening clothes, he seems to do all right.

A physican once listed five virtues of fat as follows: 1. It is a reserve of food in time of need; 2. It conserves the proteins in the body; 3. Its padding and shock-absorbing nature protect various organs against shock or vibration; 4. It keeps the individual warm; 5. It is responsible in large measure for the smoothness and elasticity of the skin as well as the shape and curve of the body. The Turks and Eskimos like their women plump and everybody prefers a smooth skin to a wrinkled one.

But true obesity, everybody agrees, is not good for you. Life insurance figures show that overweight people are apt to develop diabetes, high blood pressure, heart disease, and to die younger than those whose weight is normal. The overweight are poorer surgical risks and have less resistance to infection. Very stout women may develop complications in pregnancy.

Doctor W. H. Sebrell, Jr., director of the National Institute of Health, once put the case against fat in these words: "Obesity is associated with a high incidence of diabetes, cirrhosis of the liver, cardiovascular disease, hernia, gall bladder disease and certain forms of cancer and arthritis It may not cause these things but it is a dangerous and undesirable concomitant."

Definite underweight, on the other hand, the doctors agree is also a bad thing. In young people, it retards growth and seems to make them more susceptible to tuberculosis The underweight of all ages may be nervous, irritable, suffer from fatigue and be lacking in stamina Their resistance to infection is often lowered. The undernourished woman, who is extremely underweight, is a great obstetrical hazard

Your ideal weight is naturally the elusive "normal" weight in between at which you are well nourished and most alert physically and mentally Whether you are overweight depends not only on your poundage but on its character and its relationship to your height and build.

You can obtain an idea of the health of your flesh by pinching some of it between your thumb and forefinger. If it's firm and you can pinch only a layer half an inch or less in thickness, you need not worry. If it is flabby and you can pluck a fold an inch or more thick, you probably need to reduce.

Because of improved nutrition i childhood, American boys and g are now taller and heavier than of past generations, when they college. But this does not mean tha

HEIGHT	WEIGHT IN POUNDS Men	Women
4 ft. 10 in.	.. ....	112 plus or minus 11
5 ft.	125 plus or minus 13	116 " " " 12
5 ft. 2 in	130 " " " 13	121 " " " 12
5 ft. 4 in	135 " " " 14	128 " " " 13
5 ft 6 in	142 " " " 14	135 " " " 14
5 ft. 8 in	150 " " " 15	142 " " " 14
5 ft 10 in.	158 " " " 16	150 " " " 15
6 ft	167 " " " 17	158 " " " 16
6 ft. 2 in.	178 " " " 18	.... ..

they are obese or in need of special diets

Lane Bryant Co., which specializes in clothing "stylish stouts," recently revealed that its most popular dress size has dropped successively through the years from 46 to 44 and now is 42

The average American woman is now five pounds lighter than her sister of the same height was in 1912, Dr James M. Hudley of Bethesda, Md., told a recent Iowa State College conference on weight control His figures from the U S Public Health Service indicated that American men have gained an average of five pounds in the same time Still nobody has seen lately—even in a circus—a man to threaten the fat record of Daniel Lambert of England. A century and a half ago he weighed 739 pounds at age 39 and measured 9 feet around his waist

Gradual increases in weight in later life used to be considered normal. We are now supposed to reach our adult weight between 25 and 30 years and maintain it.

But as we grow older, our activity usually becomes less and v equire fewer calories This is one of the variables emphasized in the recommended dietary allowances of the National Research Council's Food and Nutrition Board Recommended is a daily intake of 3,200 and 2,300 calories respectively for a fairly active "standard" 25-year-old man and woman living in a temperate climate with a mean temperature of 50 degrees Fahrenheit. This is about the climate of Boston, Chicago and Detroit.

The "standard" man weighs 143 pounds and the woman 121 pounds Bigger persons need more calories, smaller ones fewer. As they grow older, the "standard" couple should decrease their calories 7.5 percent for each additional decade. If they move to a warmer climate, they should cut their calories, if they shift to a colder area, they should increase them If they change their activity, they should change their calories. If the woman becomes pregnant, she will need 2,700 calories and, w nursing mother, 3,300 calori protein, vitamin, and calci also increase.

A calorie, incidentally,

or energy required to raise the temperature of a kilogram of water one degree Centigrade, about the same as required to raise one pound of water four degrees on the Fahrenheit scale.

Even while we sleep, our bodies consume half a calorie per pound of weight per hour. Sitting requires three-fifths of a calorie per pound, and standing requires three-fourths of a calorie. Light exercise takes 1 calorie, moderate exercise 1¼ to 1½ calories, and severe exercise 3 or more. Dr. Henry C. Sherman, Columbia University nutritionist, says that a teacher burns up 120 to 200 calories an hour lecturing to a class and that students sitting and listening expend 100 calories or so.

One means of calculating "ideal" weight in pounds has been proposed: multiplying the number of inches of height above 5 feet by 5½ and adding the result to 110. The result, of course, is an approximation. The latest official chart of "desirable weights for height" is the one produced in 1953 by the National Research Council, (See previous page.) showing the plus-or-minus limits within which desirable weight may vary from the average.

Are you within the limits shown on the chart? Is your general health good? Are your eyes bright, your hair glossy and alive, your skin smooth, your disposition cheerful? If so, you need not worry about diet and weight.

If you are only a very *few* pounds outside these limits and are in good health, you may bring your weight up or down yourself by a little attention to your food and exercise. It has been the fashion in recent years to deride exercise as a means of weight control. Violent exercise, of course, increases appetite and may be dangerous to older persons. But walking now and then instead of riding is another matter.

If you are happy with what you are now eating, your may bring your weight up or down a little simply by eating more or less of the dishes to which you are accustomed. It is not the calories from any particular food but the excess calories—the calories eaten over and above those consumed by your body—that add pounds.

If you would like to try a diet, and still assuming that only a few pounds are involved, you might follow one of the many based on the seven basic food groups publicized by the Department of Agriculture and endorsed by National Research Council's Food and Nutrition Board.

Daily eating of something from each of these seven groups in adequate servings supplies all of the more than 50 different nutrients, most of them discovered only in the last 30 years, that science believes essential for body fueling and repair.

These groups are:

- 1. Leafy, green, and yellow vegetables. One or more servings.
- 2. Citrus fruit, tomatoes, raw cabbage. One or more servings.
- 3. Potatoes and other vegetables and fruits. Two or more servings.

- 4. Milk, cheese, and ice cream. Two or more cups milk (adults). Three to four cups milk (children).
- 5. Meat, poultry, fish, eggs, dried beans and peas. One to two servings.
- 6. Bread, flour, and cereals (whole grain or enriched). Some each day.
- 7. Butter and fortified margarine. Some daily.

You should beware of any diet that promises to cut a lot of weight in a very few days. It can't be done safely. You should be wary of diets that skip breakfast Studies at the State University of Iowa have shown that persons who had no breakfast did less work, were slower in their reactions and were generally adversely affected.

While salt-free diets are prescribed for certain ailments, you should not undertake one on your own You run the risk, especially in hot weather, of heat cramps, heat shock and heat stroke by depriving your body of salt

You should beware of diets which call for raw milk. In drinking such milk you risk tuberculosis, typhoid fever, undulant fever and other maladies

Diets without milk, meat, or eggs are to be avoided. Milk is our oldest and most nearly perfect food It supplies virtually everything needed by the body except iron. It is an especially good source of bone-building calcium and belongs in almost any diet. If weight reduction is required, skim milk or the new non-fat dry milk may be used. If you can't drink ordinary milk, you can have food prepared with the non-fat dry milk powder.

If you are seriously overweight (more than 10 percent above the normal range) and show any signs of illness, you should undertake nothing in the way of diet or reducing without consulting your doctor. Persons suffering from true hyperinsulinism, Addison's disease, gout, liver cirrhosis, duodenal and gastric ulcers risk their health by undertaking the usual reducing diet

While it is now fashionable to blame practically all overweight on over-eating, and to say that the only glands involved are the salivary glands, Dr Mayer of Harvard and others emphasize that "multiple" factors may be responsible

"In obesity," he says, "these factors are heredity, bodily or mental injury, and environment That genetic factors are of paramount importance in obseity is well-known to animal breeders who for centuries have selected strains of hogs, poultry and beef cattle on the basis of fat"

Hereditary factors are more important in weight than is generally realized, says Dr H. W. Bansi of the University of Hamburg, Germany. If your parents and grandparents were big-framed and you are of the same type, you may get into trouble trying to weigh less than th did. Some healthy and people are simply *big.* de Milo had a 39-inch inch hips. Nearly 40

American women are naturally larger in some or all of their dimensions than the perfect 36 figure idealized by designers and artists.

Even if your obesity seems simply a matter of overeating, your doctor will want to know if you have some special reason or excuse for it. Some fat people eat, in the words of Dr. Charlotte M. Young, professor of medical nutrition at Cornell University, "as a consolation against superficial emotional problems." If you are overeating because of loneliness, frustration, grief or general irritability, you must free yourself from or adjust to these problems before any weight-reduction program can be of permanent value.

Once your doctor knows the facts of your overweight, he may be able to do a great deal for you. He can first of all give you a diet specifically tailored for your individual needs. He can enlist psychiatry if required. He may suggest exercise or a change in your living pattern. If necessary, he may prescribe vitamin and mineral supplements and other drugs.

Drug therapy for obesity fell into disfavor because of trouble a few years ago with a product called Dinitrophenol. It stimulated the body to burn up food and excessive fat but sometimes caused the patient to be cooked almost to death by the heat generated. Several newer and safer drugs which function in a different manner are now available

Amphetamine, metaphetamine and similar drugs depress the appetite and cellulose provides bulk to fill the stomach. For persons who are heavy because of abnormal fluid retention, diuretic drugs such as the new Diamox may be employed. The dosage of all of these must be adjusted to the individual; use must be supervised by a physician.

Then there are food allergies. If you have one, your doctor will take it into consideration in working out the best diet for you

"The first serious drawback to ready-made diets," warned Dr. Max Millman recently in a publication of the American Medical Association, "is that they advocate the same food and the same number of calories for all would-be reducers. This is a mistake. A diet is a prescription which, instead of drugs and chemicals, calls for definite amounts of specific foods. It therefore has to be individualized. No single list can suit all, no more than a shoe or hat fits everybody..."

ONE OF NATURE'S most devoted fathers is the male sea horse—and with good reason. For it is the male sea horse that has the babies During mating, the female deposits her eggs in a pouch on the underside of the male's tail. He carries the developing eggs about with him in the distended pouch for several weeks. On the happy day, the sea horse may have up to 400 "colts," about the size of this (,) comma. After that, though, the sea horse thinks he has done enough, and leaves the young to fend for themselves.

ANIMALS THAT USE TOOLS

by Willy Ley

Condensed from a chapter of the book, Salamanders and Other Wonders

ˀOME ANIMALS, a fair number of Ↄ them in fact, use tools.

My first example is an insect; to e systematic about it, an insect of ɜe order of the *Hymenoptera*, sub-rder *Apocrita*, genus *Sphex* It is a ind of wasp—in fact "sphex" is just he Greek word for "wasp"—which n entomological English is pin-ıointed a little more precisely as one ɨf the "thread-waisted wasps," vhich I find hardly easier to pro-ıounce than sphex.

The thread-waisted wasps of the ȝenus *Sphex* all have one procedure n common: they dig narrow, nearly ·ertical tunnels in sandy soil, be-tween 1¾ and 2 inches in depth. In this tunnel they place one or several insects that have been skillfully par-alyzed by a sting into just the right nerve center, and one egg

In time the egg hatches and lives on the provisions left by the mother wasp. The young wasp, without leav-ing the tunnel, grows to its full size, emerging completely developed. But if the mother left the tunnel open, other insects or even birds would find it promptly. So, before leaving, the wasp carries sand to the hole and pushes enough in to fill it to the top, every once in a while tamping the sand with its head.

But some members of the genus *Sphex* do not use their heads directly for this purpose. Instead, they take a small pebble in their "jaws," or mandibles, and pound the loose sand in until it is as firm as the undis-turbed soil around the tunnel.

Another true use of a tool by an insect is the "weaving" of ne the emerald ants of Java, In Ceylon. The leaf house of' *phylla* ants is high up" and the leaves are the

---

of the tree which are woven together by silky threads. It was just this fact which used to be puzzling, since the *Oecophylla* ants were never seen to spin a thread when observed on the ground. It was less than half a century ago that a traveling zoologist, Franz Doflein, observed what actually took place up there in the boughs.

Worker ants, working in regular gangs, held the leaves together, clinging to the edge of one with all six legs and holding the edge of the other leaf with their mandibles. If the distance between the two leaves was too great, an ant would climb out to the edge and would be held by the mandibles of another ant. Then a third would climb out to be held by the mandibles of the ant farthest out, and so on. They produced chains of seven or eight ants to reach the edge of the other leaf.

Once this had been accomplished the whole chain would slowly retreat to the leaf on which the supporting ant was standing, until the leaves had been pulled together sufficiently so that they could be held in place by a single row of ants. Then another gang of workers would appear, each one carrying an immature ant, or larva, in its mandibles. Franz Doflein then saw that, while the adult ant could not spin a thread, the larva could. Using its own larva like upholstery needles—or like shuttles, to use Doflein's term—the ant would then weave, or sew, the leaves together.

The larva of still another insect—*Myrmeleon formicalynx*, the ant lion—is the inventor of artillery. The larva digs a cone-shaped pit in dry sand and hides at, or rather under, the bottom, completely covered with sand. When an ant passes the rim of the pit the ant lion throws grains of sand with unerring accuracy, so that the ant loses its footing and slides down the side of the conical pit and into the waiting mandibles at the bottom.

One other animal "shoots" extra-organic matter (there are several—insects, reptiles, and mammals—which squirt body fluids of one kind or another) to obtain its food This is *Toxotes jaculator*, the Siamese archer fish, first brought to the attention of science in a communication read to the Royal Society of London on March 15, 1764. The member of the Society who had sent the communication was one John Albert Schlosser, a doctor in Amsterdam, but the information had come from the governor of a hospital in Batavia, Hommel by name.

When the archer fish spies a fly sitting on the plants that grow in shallow water, it swims on to the distance of four, five or six feet, and then, with surprising dexterity, it ejects out of its tubular mouth a single drop of water, which never fails striking the fly into the water, where it soon becomes its prey.

WELL-KNOWN rocket expert and natural-

ist.

However, Schlosser's story was treated with considerable skepticism. That the archer fish actually shoots water droplets has been definitely known and generally accepted only since 1902, when the Russian ichthyologist Nikolai F. Zolotnitsky reported on an extensive series of observations and experiments with captive specimens. The shooting mechanism is formed by a double ridge on the roof of the fish's mouth which becomes a tube when the tongue is placed against it.

Toxotes rarely misses. It can shoot insects on the wing, though normally the targets are insects sitting on plants which the fish stalks carefully and successfully. That the impact is sufficient to knock down any insect is proved by an observation by Hugh M. Smith who saw a *Toxotes* shoot a small lizard which fell into the water Presumably the lizard escaped, however, for the mouth of *Toxotes* is quite small and it has no weapons other than its "blowpipe" Incidentally, one should not smoke in the dark near waters where the archer fish lives or is kept To the fish the glow of a cigarette indicates a firefly or glowworm of some kind, and it extinguishes the cigarette with great skill.

Except for stone-throwing monkeys, no other animal uses missiles, but one bird has invented bombing. When the well-known British ornithologist John Gould was studying the birds of Australia over a century ago, it was reported to him that a large hawk of the inland areas, the black-breasted buzzard, [illegible] of

A THREAD-WAISTED WASP pounding sand into a hole with the aid of a small pebble; probably the only example of a true tool among insects.

the big eggs of the emu. To obtain them it would frighten a brooding emu off the eggs with sudden dives and a wild flapping of wings, then take a stone up and drop it on the eggs.

Inserting a claw into the hole in an egg broken by the falling stone it would carry it off to its nest Gould did not see this himself but the story was substantiated to a large extent by Australian bird watchers who were surprised to find the shells of emu eggs in buzzard nests.

When the interior of Australia was first explored, travelers often came across quaint little structures that had obviously been built by somebody or something. Usually located among low shrubs, they consisted of a platform of small sticks, laid side by side On two opposite sides of the platform, other sticks, a fo[illegible] half or so in length, were [illegible] right into the [illegible] walls.

If the sticks

ways placed so that they curved over the platform, occasionally forming a small tunnel. And at one end of the platform there was an accumulation of objects, hundreds of them, covering an area larger by far than the platform. There were snail shells, empty cycada shells, flowers, white and yellow pebbles, lots of small bones, bird feathers, and pieces of cast-off snake skins.

The builder of these structures was never in sight—or so it seemed—and the whole was as mysterious as possible. A Captain Stokes who traveled in inner Australia during the years 1837-43 came to the conclusion that native women had built them to amuse their children. Sir George Grey, colonial governor at the time, preferred to think that kangaroos made them, apparently on the

THE ARCHER FISH, a small fish with a flashing yellow and black-barred body, shoots a liquid charge at tempting prey. His "anti-aircraft gun" is amazingly accurate; the victim is swallowed the instant it hits the water.

theory that such a queer creature as the kangaroo was capable of anything.

Today virtually everybody knows that these are the "playgrounds," or "arbors," or "bowers" of the bower birds. The birds built them in addition to their true nests, which are simple shallow basket nests up in the trees. Australian experts are debating among themselves on whether the ground structures should be referred to as "courtship bowers," or as "playgrounds" with only incidental purpose; the important thing is that the birds built them, and that at least one, the satin bower bird, uses a tool in doing so. The tool is not used for the building itself, which is done with the beak, but in a finishing operation, which is painting

That the birds actually indulge in this practice was definitely established by observations in the National Park of New South Wales around 1930. An Australian ornithologist, Alec H. Chisholm, wrote as follows:

"Many times I had seen bowers containing blackened sticks and had imagined these to have been charred in fires. That hasty conclusion was dispelled a few years ago. It was established then that the bird actually brings charcoal to the bower, munches it into a paste, and, holding his head sideways, paints each stick of the inside walls with his beak! Moreover, he carries fragments of soft bark to the bower and holds one of these in the beak while applying the mixture. We surmised at first that these scraps of bark were used as

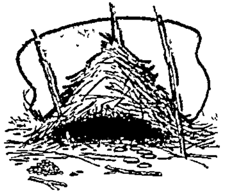
rushes; but it now seems more probable that they are by way of being stoppers, or corks, to prevent the mixture oozing from the tip of the beak, while it is being applied to the walls with the sides of the beak."

Apparently birds, because they habitually carry things around in their beaks, have repeatedly found that something held in the beak will make a tool. One large parrot-like bird of New Guinea is known to feed almost exclusively on very hard and very smooth palm nuts. Occasionally it carries them around, with the nut wrapped in a coarse leaf so that it cannot slip away.

Some small insect-eating Australian birds use a dry stalk of grass to pry for insects under loose bark where their short bills do not reach. The finches of the Galapagos Islands—almost, though not quite, at the antipodal point from their Australian colleagues—do the same.

The bowers of the bower birds were not the only bird structures in Australia which were mistaken for something else by early explorers and settlers. Visiting scientists were occasionally told by settlers that there were "native burial mounds" in the scrub in this or that direction. There were mounds all right, and of considerable size too—one was 15 feet high and measured some 60 feet in circumference — but they were not made by the natives and had not served for burials.

They were the product of the mound-building birds of Australia, of which there are three kinds: the talegalus (the Australians call it scrub turkey), the megapodes, and the mallee-fowl. Mound building begins at the end of the Australian winter (say late in August), and when the mound is large enough the birds place their eggs in the mass of decaying vegetation. The eggs are arranged in a circle, a few inches apart, and are placed so that they rest in a vertical position, with the more pointed end downward.



BOWER of the Brown Gardener Bower-

birds' semispherical waterproof hut.

The distance from the eggs to the top of the mound varies, in some cases it was just two feet, in others as much as five feet. Far from being burial mounds, the heaps of soil and leaves are incubators, kept at a useful temperature by the chemical heat which is generated by the decaying plant matter.

The oldest egg incubator built b human beings is rather old by man standards, since it was ma ancient Egypt, but the Aus version is certainly much o

is old enough to have caused profound changes in the birds as well as in the eggs. The birds no longer practice "normal" brooding at all. And the eggs have shells so fragile that they cannot be hatched by domestic chickens; hens will invariably break them. But people have succeeded in hatching such eggs by imitating the bird's mound.

Color Experts Don't Agree

Expert color testers are not as expert as they may think, the National Bureau of Standards has found.

The men who OK'd the dyes for that new dress, approved the paint on your living-room walls and made sure the finishes on the different parts of your gas range matched, disagree widely among themselves in judging color differences

When 19 experts put their heads together to rate colored tiles—noting for instance if one was redder, lighter or weaker than another — their average judgment was only a little better than that of 15 non-experts.

[illegible] National Bureau [illegible]

much and in what ways two colors differ. It would be faster and more accurate than the expert samplers that today do about 90 percent of the industrial color testing.

But the machine is a difficult assignment. "We ought to have one by 1965," Dr. Deane Judd, who is coordinating the NBS project, said.

Artificial Eyes Tell No Tales

Nowadays an artificial eye can go absolutely unnoticed, the Better Vision Institute asserts Thanks to modern ingenuity, it can match its living mate very closely and move with it.

There was a time when the glass-eye craft was known to only 16 people from the same German village They handed their secrets down from father to son, so that their artistry was kept a monopoly for about a century. But, when World War II created a grim shortage, American science broke the monopoly by developing the plastic eye.

Today a one-eyed person can get a plastic eye which not only fits precisely, moves with the real eye and matches its color, but even has the same vein pattern, formed by fine rayon threads spread carefully across the artificial eyeball. Sometimes an extra hangover eye is obtained, to match the real one when it's bloodshot!

Artificial eyes are being worn by women whose husbands are unaware of them, by a successful surgeon whose associates don't know he is one-eyed, by a woman who won the Miss America title, by TV artists, movie stars, models, professional athletes, and children.

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"TRUTH SERUM" NO BETTER THAN WHISKY

The so-called "truth serum" is no more reliable for making people tell the truth than is a large shot of whisky, Dr. John M. Macdonald, consulting psychiatrist to the District Courts of Colorado, reports to the *Journal of Criminal Law, Criminology and Police Science.*

The name "truth serum" is misleading on two counts, Dr Macdonald points out. The drug used, formerly scopalamine (twilight sleep) but now usually a barbiturate, is not a serum and it does not always lead to the truth

"The intravenous injection of a drug by a physician in a hospital may appear more scientific than the drinking of large amounts of bourbon in a tavern, but the end results displayed in the subject's speech may be no more reliable," Dr. Macdonald comments.

The innocent suspect is not assured that he will be cleared of suspicion by use of the truth drug. Persons under the influence of drugs are very suggestible and may "confess" to crimes which they have not committed, especially if the police officer says something like· "You did steal the money, didn't you?"

The guilty suspect is by no means always induced to confess under the truth serum If he can withstand competent and prolonged interrogation, he can usually withstand interrogation under drugs. In fact, Dr Macdonald has found that:

"The confident criminal relishes the prospect of examination under drugs. He welcomes the opportunity of making self-serving statements in the pseudo-scientific atmosphere of the truth-serum test "

The suspect who fakes loss of memory is usually able to continue the deception under the truth serum, Dr. Macdonald has observed

The only situation in which the truth serum actually aids justice is that of the person with a genuine loss of memory. Then, the drug may serve to bring the facts to light.

FATHERS-TO-BE GIVE AIR FORCE A HEADACHE

Expectant fathers cause re
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Armed Forces Medical J

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FATHERS-TO-BE GIVE AIR FORCE A HEADACHE

Exp tant fathers cause real tary pr says an article in the *Arme ledical Journal* →

Medical officer James L. Curtis said that in a study of 50 airmen whose wives were expecting babies, two-thirds exhibited some disurbances, and 16 of them made serious difficulties for themselves and the Air Force. Eight had to be separated from the Air Force because of infractions of military regulations

Captain Curtis' study traced the relationship between military behavior and the physical and mental reactions of the expectant fathers. He reported the men displayed not only anxiety and irritability but developed real or imaginary ailments similar to those experienced by their wives — including headaches, stomach aches, dizziness, and even morning sickness.

Large appetites were another result of the expectant fathers' mental tortures, it was reported. Of the 50 studied, 21 showed varying degrees of mental depression, 2 of them attempting suicide.

Curtis concluded that the practical military consequences of approaching parenthood are not recognized sufficiently.

MAKE THE MOST OF ADOLESCENTS

Far from being crazy, mixed-up kids, adolescents find themselves in a crazy, mixed-up world. According to University of Michigan child psychiatrist, Dr. Ralph D. Rabinovitch, "With all his problems, the adolescent has priceless assets which given proper nurture far outweigh the negatives."

In other words, adolescents seem to have more to offer the world than the world offers them.

In an article entitled, "Our Adolescents and Their World," which appeared recently in the *English Journal*, Dr. Rabinovitch gets down to cases, picks up a few child-psychology chestnuts and replants them in the soil of common sense. For example:

• 1. "Give the boy his head." Parents nowadays tend to take the adolescent's striving for independence so seriously that they pull the family rug of security out from under their children.

"In some families," declared Dr. Rabinovitch, "it is as though parents no longer dare to direct a child after he has reached the magic age of 16."

The U-M doctor added: "It is certainly nice to grow up with one's children, but it is also wise to be more mature than one's children."

• 2. "Comic books are the evil of the time." Actually life itself is more gruesome than the comic books. And it turns out that the really gruesome comic books are more often read by adults than by children.

Doctor Rabinovitch says he does not doubt that some horror comics are unsavory and disturbing to children, but states that modern bogies such as housing scandals, tax frauds

d professional liars in government : far worse because the children ve no escape from them.

"At least," said the doctor, "in *perman* and *Mighty Mouse* the ild knows that good triumphs over il."

3. "Give adolescents solid courses sex education." Like most pana-as, this one represents a gross over-nplification

It is helpful but not enough, de-ared Dr. Rabinovitch, to teach chil-en the anatomy and physiology of xual functions. Furthermore, such aching is actually of secondary im-ortance

"The primary elements of sex edu-ition are found in family relation-ips, in feeling tones between par-nts, and in feeling tones between arent and child," said the U-M hild specialist.

"After all," he added, "sex educa-ion is education in living."

ENNSYLVANIA DUTCH "ABOUT ALL"?

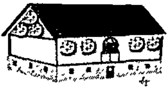
After more than 200 years as a iving language in this country, the inique native dialect of Pennsyl-ania Dutch is passing into disuse, he National Geographic society ays. A generation hence it will be 'about all."

In eastern Pennsylvania's great valley, between the Delaware and Susquehanna Rivers, lies the land of the plain people—Mennonites, Amish, and Dunkards — who brought their tongue to William Penn's religious haven in the early 1700's.

Though English words crept in, the basic language remai d archaic German down to the 20th century.

Even now, perhaps half the people of Lehigh, Berks, and Lebanon Counties speak Pennsylvania Dutch. Most of them also speak English.

At least three colleges—Pennsylvania State University, Franklin and Marshall, and Muhlenberg — today offer courses in Pennsylvania Dutch. A literature is growing in the language, although it is chiefly a spoken tongue.



Everyday English as spoken deep in Pennsylvania Dutch country shows weird and wonderful flavor Many classics are known far and wide, such as "Did you bell? Sure I belled, but it did not make!" This leads to a sign hung by the door, "Bell don't make. Bump."

Housewives instruct their children, "Run the stairs up and shut the windows down. The paper wants rain " Again they might say, "Outen the light, the electric is not to waste."

In Dutch talk, "strubbly" hair is disheveled as no other word could describe it. A "klook" is a mother hen; her chicks are "peeps " A small paper bag is a "toot" ("Shall I put it in a toot, or do you take it so?")

Adverbs are used with great abandon, as in "Don't let her run off no yet," or "I've known her lo ready."

Giving directions to a s town might produce s

ploding a metallic wire with a stiff jolt of electricity. This might give a sufficiently high temperature. The fusion temperature may even be lower than once was thought necessary.

Shock waves also might trigger fusion of light elements. When matter at one pressure passes through matter at a very different pressure, shock waves generating high temperatures occur. Pressure ratios of about 500 correspond to 20 times the velocity of sound and, in the gas, argon, this would create a temperature of 16,000 degrees, one scientist has calculated.

Theoretically, a mass of hydrogen changed into helium yields over seven times as much energy as an equal mass of fissioning uranium. The nuclear fusion process, creating helium, would imitate the process by which the sun is stoked.

Useful Fuel from Thorium

The way to purify atomic fuel manufactured from thorium, a cheaper and more plentiful atomic source than uranium, was announced to the world by the United States at the Conference as an aid to atomic power development.

Doctor Alan T. Gresky of the Oak Ridge National Laboratory made known the method of separating fissionable (burnable) uranium 233 from the thorium 232 and the protactinium 233 from which it is converted in breeder reactors.

While it has been known that thorium, a fairly widely distributed ele- can be changed by neutron bombardment into a kind of urai um that can be used for atomic po er, the way of getting it separat from debris and non-burnable n terial has hitherto been kept secr

First the thorium is placed like blanket around an energy-produci core within which atomic fuel "burning." Excess neutrons are ca tured by the thorium to convert into a kind of uranium that is fissic able or burnable. The result is th 115 percent of the original fuel obtained, a breeding gain of abc one-seventh. Separating this n fuel from the unchanged thori and the fission products has beer stumbling-block.

Now, Dr. Gresky tells how t can be done chemically. Nitric a is used as a solvent and organic so tions are then used to separate uranium and the thorium. T atomic fuel is purified by ion change and evaporation so that can be handled without danger of posure to intense radioactivity fr the fission products.

New Elements Named

The names of two great scienti who died within the past year, bert Einstein and Enrico Fer were immortalized by the christ ing of chemical elements 99 einste ium, and 100 fermium, it was a nounced at Geneva by Dr. Alb Ghiorso of the University of Calif nia at Berkeley.

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H-bomb explosion. The discovery was made by Dr. Glenn Seaborg of the University of California.

A group of scientists led by Dr. Seaborg later made einsteinium and fermium in a cyclotron and in nuclear reactors at Berkeley, Argonne National Laboratory and at Los lamos.

The symbol for element 99, eineinium, is plain E. That for 100 is m. Now all discovered elements re named, since 101 was previously amed mendelevium after the Russion D. Mendelyeev, who announced he periodic system of the elements n 1869. This name pleased the Rus:ians who placed it on the giant peri›dic table of the USSR exhibit at the International Conference.

The Russians are expected to replace their labels for 99, athenium, and for 100, centurium, with the announced U.S. names

Naming the new elements was delayed by secrecy imposed by their creation in the thermonuclear reaction when uranium 238 added 17 neutrons in one jump, becoming einsteinium 255, which changed to fermium 255 by electron loss.

The elements were found in H-bomb dust picked up about 200 miles from Eniwetok.

Subsequently both 99 and 100 have been made in the cyclotron by bombardment with nitrogen 14, and in a reactor by successive neutron irradiation of plutonium

Doctor Ghiorso predicted that sufficient quantities of element 99 to be visible microscopically would be available within a year, ' ce one form has a half-life of one year. Within four years, the discovery of elements 102, 103, and 104 will probably be made as a result of the bombardment of heavy elements with heavy particles. Dr. Ghiorso reported atoms with 152 or more neutrons change themselves spontaneously at a terrifically enhanced rate, as fermium does

Also, atomic hearts twice as heavy as any now known can be made by "fattening" lighter elements with neutrons, Dr. John A. Wheeler of Princeton University, predicted

"Massive" doses of neutrons would be needed to make the "superheavy" nuclei, which would be the heaviest form of matter on earth. Such atomic hearts would be unstable and break up into smaller fragments, but would live long enough to be studied.

More Powerful Atom Smashers

The possibility of constructing atom smashers to create artificially atomic particles with enormous energies, up to 10,000 billion electron volts, was predicted by Prof. Vladimir I. Veksler, a Soviet physicist

Professor Veksler independently invented the principle of synchrotron resonance, which the American scientist and Nobel prize winner, Dr. Edwin M McMillan of the Unive - sity of California, also discovere 1944.

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Energies of 10,000 billion electron volts are about a thousand times h... those of primary cosmic rays ... charged particles

continuously smashing into the earth's outer atmosphere from all directions in space.

Doctor Veksler believes that present smashers will reach their limit at about 10 billion to 20 billion electron volts. He said that the Russians are now building an accelerator designed to reach energies of 10 billion electron volts.

Doctor Ernest O. Lawrence of the University of California at Berkeley reported to the International Conference on Peaceful Uses of Atomic Energy that an accelerator of even greater energy than 10 billion electron volts was being built in the U.S.

Both accelerators will be operating by 1956

Synchrotrons are atom smashers designed to accelerate either electrons or protons. Both the cosmotron at Brookhaven National Laboratory, reaching energies of about 3 billion electron volts, and the bevatron, at the University of California, designed for energies of 6 billion electron volts, are synchrotrons.

Wealth from Atomic Waste

Waste debris from atomic reactors promises to be more valuable in future years than electricity produced from them, Dr. E. Glueckauf of the British Atomic Energy Research Establishment, foresees.

Radioactive strontium, one of such products, absorbed in baked clay is a usable heat source for 50 years and requires little shielding, the British scientist said. Cesium, another waster atomic product, is a valuable source of gamma radiation, which is the same as from radium

After 13 years, the metals ruthenium, rhodium and palladium and the rare gas xenon are no longer dangerously radioactive, and can be recovered. At present prices, these four "waste" products from burning 20 tons of uranium would be worth $3½ million.

An aged solution of debris from atomic reactors would also be a source of technetium, an element that does not occur in nature, but is known only in its radioactive forms one of which is produced in the fission of uranium 235 and plutonium.

Substantial quantities of neptunium and americium from atomic reactors could also probably be used. Both neptunium and americium are artificially-produced elements, heavier than uranium.

Russian A-Power Plant

The first detailed description of Russia's first atomic power plant issued by Soviet scientists at the Conference brings this verdict:

The Russians clearly understand the problems of atomic power development. They have learned through their own research, as America has learned, the essential information to allow them to build and operate successfully an atomic power reactor.

The Russian power reactor with an output of 5,000 kilowatts began generating electricity at an unrevealed location on June 27, 1954 according to the paper presented by D. I. Blokhintsev and N. A. Niko-

layev. Its fuel is enriched uranium containing 5 percent of the fissionable uranium isotope 235, and the total charge is 550 kilograms (1,210 pounds).

The small Soviet power plant is described as the forerunner of a 100,000 kilowatt plant that is reported as being planned Speculation is that it may actually be under construction and that, if completed in 1956, it could be the first large atomic power plant, nosing out the British 50,000-100,000 kilowatt plant at Calder Hall and the 60,000-plus kilowatt U. S. plant at Shippingport, Pa , due for completion in 1957.

While the cost of electricity from the first Soviet atomic power station "exceeds considerably the average cost of electricity from powerful heat-power stations in the USSR," the Soviet prediction is that larger plants now being designed (10 to 20 kopeks per kilowatt hour) will produce in a cost range from that of present coal-plant electricity to double that value.

The Atom's Future

Atomic power will be producing the greater part of the world's electricity in the year 2000 and the amount of uranium or thorium consumed annually will be 2,000 to 3,000 tons, said Sir John Cockcroft, head of Britain's Atomic Energy Authority.

These immense amounts of atomic elements, together with additional requirements of uranium for starting new reactors, will be available with little difficulty, Sir John reassured the world meeting of experts. Reports on uranium supplies of the world show that there is ample amount of the essential material that can be extracted from the earth in the future.

The United Kingdom will burn 250 tons of uranium or thorium annually by 2000, which is the equivalent of 250 million tons of coal. He expects that breeding, making fissionable material out of thorium and the kinds of uranium that are not fissionable, will then be fully developed.

Greatly increased efficiency in the amount of energy obtained from uranium is expected by Sir John He predicts that one ton of uranium will do the work of a million tons of coal. At present the figure is 10,000 tons of coal per ton of uranium

Doctor J V Dunworth, British atomic authority, has shown that by recycling uranium several times in power reactors, it may be possible to increase the heat extraction per ton of uranium to as much as 100,000 tons of coal. Still greater improvement is expected by Sir John through use of fast breeder power reactors, which will utilize the fissionable energy of all the uranium, bringing the hundred-fold gain foreseen.

RED LOOKS PINK 15 feet below the sea; yellow, true to 120 feet, where it begins to turn gr

tually lick the outside of their eyelids with their tongues; and the chameleon, an African lizard, can shoot its tongue to a distance half or more the length of its body, the organ thus serving as a sort of sticky lasso to snare the prey.

THINKING of the gift of tongues brings to mind also the tongues of birds, particularly those of woodpeckers. Who hasn't seen a flicker or golden-winged woodpecker, as he is often called, hopping awkwardly about the lawn, but stopping every minute or so seemingly to rest his head on the tip of his beak as if in dozing meditation? When thus seen, Mr. Flicker, however, is far from being asleep. The tip of his beak, upon which he appears to be resting, is actually inserted into the door of an ant colony, and that amazing tongue of his is deep into the ant den, probing its halls for the trapped ants, his chief food. He is so absorbed in his task he often will allow you almost to pick him up. In fact, one did so far forget himself as to allow me to lay my hand upon him.

I shall never forget my surprise on first seeing the tongue of a flicker. My dog had killed one — probably while it was ant-catching—and had proudly laid it at my feet. The tip of its barbed tongue was protruding slightly so I idly pulled at it. To my astonishment, the tongue stretched out a hand's breadth or more from the tip of the beak, and when released returned slowly into the bird's mouth as if being pulled back by the recoil of a spring. As it was, in actual fact. For a little dissecti showed me, what every bird m knows, namely, that the woodpe er's tongue is different from that nearly every other creature. For the back of the mouth it joins on the two greatly elongated horns the hyoid bone; horns which wl not stretched out curve backw and upward under the skin, over bird's head, their tips actually rea ing into the right nostril. The wo pecker thrusts out its tongue means of muscles; it is pulled b into the mouth chiefly by the ela recoil of the long, springy hy bones which snap back into p like watch-springs suddenly relea

WHAT of our own tong Well, for one thing, they much larger organs than mos their possessors suppose, as easily be seen by comparing a cow's tongue with that same so tongue when seen in a butcher s The part of our tongues we can trude from our mouths is onl relatively small part of the w muscular mass we call the ton Also, those who study the ori and beginnings of the various p of our bodies tell us that our to is really a double organ made u two tongues, so to speak—a prin one which the fishes first had still possess), and a secondary which the later backboned an developed. Certain it is that a f tongue is a very different organ our own. It is not a muscular t it can't move very much, can' thrust from the mouth, and it ca

7. Use of ligature to control hemorrhage.

A French military surgeon of the 16th century, Ambrose Paré, introduced the idea of tying a string around the blood vessel to check the blood flow

8. The conquest of scurvy.

A British naval surgeon, James Lind, showed in 1747 that a daily ration of an ounce of orange juice would prevent scurvy. The disease, it is estimated, took the lives of more than a million sailors between 1500 and 1800. The work also established the concept of deficiency diseases due to lack of vitamins and other food factors.

9. Discovery of the stethoscope.

Accomplished in 1819, it laid the foundation for modern knowledge of chest diseases.

10. Discovery of the sulfa drugs and antibiotics

In 1910, Dr. Paul Ehrlich produced the first synthetic drug for a specific disease. Known as salvarsan, it had a direct effect on the organism that caused syphilis This opened the way to the sulfa drugs and later penicillin and other antibiotics that go straight to the germs that cause diseases.

PITUITARY SURGERY FOR YOUNG DIABETICS

Removal of the pituitary, sometimes known as the "master" gland, located at the base of the brain, has helped six severely diabetic children, Dr. Laurance W. Kinsell of Oakland, Calif., reports to the American Diabetes Association

After the surgery, the children got along on 1/4th as much insulin. Their high blood pressure disappeared and their eye and kidney complications improved.

The children take thyroid extract, cortisone and sex hormone, as well as insulin, to replace those hormone secretions lost as a result of surgery

RACIAL DIFFERENCES DETECTED CHEMICALLY

Significant chemical differences between the Chinese and the European have been detected in urine samples studied by University of Michigan investigators.

The Chinese were found to excrete significantly greater quantities of amino acids than the Caucasoids. Diet is not the principle factor in this difference.

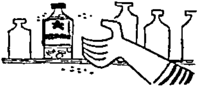
The finding adds to the body of knowledge [illegible]

The chemical structure of the urine has been added as another clue to what man really is and what made him that way, report H. Eldon Sutton and Philip J. Clark of the medical school.

The two scientists conclude the world is divided into huge racial chemical factories whose products may resemble one another but which, after careful analysis, are found to be truly unique. →

WARNINGS URGED ON ASPIRIN BOXES

"Keep out of the reach of children" is a warning that should appear on all packages containing aspirin, says the committee on toxicology, American Medical Association.



Of 113 deaths in the United States known to have been caused by salicylate compounds in 1952, 86 occurred in children under the age of five; 41 were caused by aspirin.

The committee also advised that individual pills be wrapped in foil hard to remove by children.

PREDNISONE PROMISING IN ARTHRITIS TREATMENT

Further reports on the drug prednisone continue to cite it as superior to cortisone in treatment of rheumatic diseases.

Doctors Jack R. Dordick and Edward J. Gluck of Beth Israel Hospital, New York, said a study of 15 patients, including 12 with rheumatoid arthritis, shows the new hormone compound may have distinct advantages in treating patients with joint pain, tenderness, stiffness and inflammation.

Within one day, the arthritis patients reported disappearance of pain and lessening of stiffness after taking prednisone, the doctors reported in *The Journal of the American Medical Association*. Prednisone appears to have fewer side effects than cortisone compounds.

OPERATION STILL HELPS IN HIGH BLOOD PRESSURE

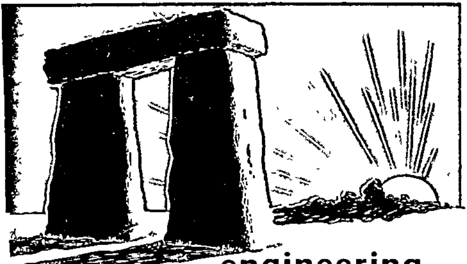
The advent of new drugs has sidetracked an old operation for high blood pressure temporarily, but it will regain its former popularity, in the belief of Dr. Adrien Verbrugghen, professor of neurological surgery, University of Illinois.

While the new pressure-dropping drugs have benefited many, others have not been helped or have encountered undesirable side-effects These persons still will have recourse to the operation, the doctor reported in *Industrial Medicine and Surgery*

The operation consists in severing the chain of nerve fibers lying along either side of the backbone. The nerves control small blood vessels that tighten up under stress of worry and anxiety and thereby elevate the blood pressure.

Known as sympathectomy, it has given many years of active, comfortable living to hypertension victims, Dr. Verbrugghen says.

HURRICANES (actual and anticipated) along the east coast of the United States in 1955 were nicknamed as follows. Alice, Brenda, Connie, Diane, Edith, Flora, Gladys, Hilda, Ione, Janet, Katie, Linda, Martha, Nelly, Orva, Peggy, Queena, Rosa, Stella, Trudy, Ursa, Verna, Wilma, Xenia, Yvonne, and Zelda. This method of designating hurricanes was made official in 1953.



engineering marvels of the ANCIENTS

by *Herbert J. Spinden*

Condensed from Natural History

ATOP A SKYSCRAPER in any modern city, you see what derricks and elevators can build of steel and stone. But most of the stones used in our skyscrapers are puny compared with the ones that the ancients ut out of solid rock and moved by nanpower alone.

At Stonehenge, about 80 miles vest of London, primitive people rected upright stones 22 feet high and placed a capstone 15 feet long on op of them. They did this with no draft animals and with no engineering science as we know it. How did they do it?

The answer of the archeologist is: "They did it the hard way." They probably built an inclined road and dragged the stones up it, possibly on primitive sledges, with mud as a lubricant. At the top, they toppled the columns over and implanted them in an upright position. The crosspiece was then slid into place.

The same answer of hard work and know-how must have sufficed with many other megalithic, or "big stone," projects. The Great Pyramid of Cheops at Gizeh, near Cairo—one of the Seven Wonders of World—is a solid mass of blocks covering 13 acres. blocks weigh up up to five

Natural History (May '55), 79th St. at Central Park W., New York 34, N. Y.

upper ones are somewhat smaller.

The total weight of about five million tons was moved into position mostly by human power; and it is generally agreed that the early Egyptians did not have rollers to ease the task. Canals were plentiful in the region, and high water helped to float bargeloads close to the site. But the heavy stones were then pulled up inclined roads and coaxed into place.

When, in 1924, the Egyptologist Ludlow Bull summarized the modernity of ancient Egypt, he explained that the power of the Pharaohs increased during the 500 years before Cheops to a point where this ruler was "able to keep 100,000 men . . . working for 20 to 30 years to quarry 2½ million blocks of stone, each weighing from 2 to 5 tons, and to pile these up in a great mountain covering 13 acres on the ground and rising 450 feet into the air, nearly as high as the Washington Monument—all this solely to receive the discarded carcass of one man." For the Pyramids were king's tombs.

The Pyramids of Gizeh set a standard impossible for the ancient Egyptians to maintain through the centuries, but the Pharaohs continued to build other massive monuments, including innumerable colossal single-stone statues, some nearly 70 feet high and weighing several hundred tons.

HERBERT J. SPINDEN is curator emeritus of American Indian Arts and Primitive Cultures at the Brooklyn Museum.

In other parts of the world, it was to glorify a man or event that early people constructed gigantic monuments like the Inca fortress of Sacsahuaman, which looks down on Cuzco in Peru.

Other great buildings of the past were erected for religious purposes, such as the massive Cambodian structures in the jungles of southeastern Asia and the Maya temples of Yucatan.

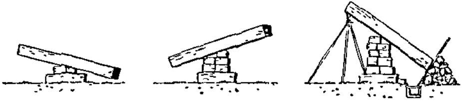
But whether conceived as an expression of the ego of a powerful individual or as a tribute to a god, these great edifices required the concerted physical effort of great numbers of individuals. In many cases the workmen were slaves.

For this reason, such great works could not be built before man had cast off nomadism and built himself settled communities. Also, in most instances he had domesticated plants on a considerable scale and also animals, though the latter may not have been useful as draft animals.

• • •

But the story of man as an engineer begins much farther back. His rise above the animals is seen in the invention of tools that gave his hand a mechanical advantage. In one instance, huge statues of human beings were carved of stone and raised into position by people in one of the most isolated spots on earth—Easter Island.

Some of the monuments are as high as 30 or 40 feet. Many persons have wondered how such figures could have been raised by the primi-



THE MAYAS, in teetering heavy stones upright, showed their talent for the dynamic as opposed to the static (Old World) engineering.

tive populations that originally inhabited this 46-square-mile island in the Pacific Ocean about 2,000 miles west of Chile.

Doctor Harry L Shapiro tells how some persons have thought that a huge population was necessary to account for the manufacture and transportation of these goliaths in stone La Perouse minimizes the difficulty by saying that a couple of levers and rollers were ample to move them But levers and rollers made of what, on a treeless island?"

Some of the stones, weighing tons, were moved 15 miles and then set up on stone platforms. The possibility that the island is a relic of a once much larger land mass is not borne out by geological evidence or b-- the distribution of the monu-nts themselves, which for the most rt follow the present coastline

In all likelihood, the monuments re carved and moved in a time ıen the island looked very much it does now, by people predomi-ntly Polynesian in culture. Esti-ıtes of early travelers indicate that ere were between 1,000 and 2,000 tives on the island when it was st visited However, the statues of Easter Island should not rank as a first class engineering feat, because they are carved of soft and lightweight volcanic stone

Man's early efforts to shape and move huge stones are interesting not only because we are sometimes unable to guess how he succeeded but also because these ancient accomplishments show so clearly the determination of the human race down through all the stages of history to gain control over the physical world

Man has never been the most powerful creature physically, yet from the dawn of his culture down to modern times, it seems to have been his ambition to gain mastery over his environment This has been possible only through the exercise of mental ingenuity

Beginning with mastery over fire, wind, and water, our ancestors asserted their desire for physical supremacy through a series of inventions that brought the energies of their environment within useful grasp and greatly improved upon the power of unaided muscle Man's higher thinking burst into spontaneously and spre *Homo sapiens* into widely

regions of the earth, and not so long ago, as the general evolution of the earth is measured.

Even allowing something less than the traditional three score years and ten, a hundred lives touching fingertips (the old man-young boy unit) takes us back to man's earliest settlements with wheat farms and livestock pastures, also to his earliest wind and water mills to irrigate fields and grind flour, and to the first sails that propelled ships, and to draft furnaces that smelted metals along the Nile and Euphrates. Even more recently, priests and kings boasted of the pyramidal ziggurats in Babylonia and the stepped pyramids in Egypt.

The beginnings of engineering science can be seen in the clues to early use of the inclined plane, the lever, and the wheel, upon which so many of our intricate machines are based.

The inclined plane has the effect of stretching the time in which one can apply his physical strength to the raising of a weight any given distance. The result is that a small force, continuously applied, can lift a large mass. The lever, in a slightly different manner, spreads the work of raising or moving a heavy object in such a way that less force need be applied at any one moment. The wheel and roller reduce friction, of course.

Precise dates are seldom available for many important tools invented before the days of recorded history. The slip pulley, not yet wheel-bearing, is an old easement device for raising sails in the Old World or loading draft animals there and in old Peru. The taming of spirited horses in the Far East inspired the chariot; other wheels were common in Babylon, Egypt, Greece, and Rome but absent from the Western Hemisphere except in playthings in clay or gold from Mexico to Panama.

The roller was probably widespread in ancient cultures. The fly-wheel, used early in the spindle whorl and the fire drill, was more important in its ultimate implications than the wagon wheel.

The tripod as a lifting device seems to have been developed independently and exclusively by the American Indians. It is the only simple lifting device that makes lifting easier the higher you go. Hands or shoulders can help at the beginning, and once the object is overhead, the principle reaches full utility. For then each time one of the feet is moved a foot, the weight is lifted only inches.

An ingenious use of the tripod is seen in South America. Certain Indians are known to erect three tripods in a triangle to support three hammocks when camping on a river bar. Inventions of this sort may seem trivial in our technical era, but they are really indicative of great ingenuity.

The tripod-jack may even have prepared the reasoning of the Maya priests for their remarkable and distinctive mathematical system. This system enabled them to solve mathematical problems involving three un-

equal quantities by bringing them together to a common union in a pattern of thought inescapably similar to the three converging legs of the tripod. They applied this system to astronomy in a way that is seen nowhere else in the world, to reckon time from a definite point in astronomical history.

Study indicates that the Mayas erected their massive stones by teetering and blocking, whether or not this was the case elsewhere in the world The tallest stones of Quirigua, in eastern Guatemala, were moved two miles from exposed ledges—where rough blocks had been separated along natural cleavage lines—to the city plaza A cobblestone road has been located, over which it seems likely the stones were moved by skidding on stoneboats, with mud as a lubricant.

In the plaza, they were set up over cavities containing religious offerings. Each stone, after being balanced across a flat stone with a pit on either side, was tilted seesaw fashion by men walking alternately from one end to the other When the stone had been blocked high enough, it was slid into place over its cavity

In Peru, huge and seemingly unmanageable stones were slid snugly into place to form some of the most astonishing walls of ancient times A counterweighting technique based on the principle of the lever may have been used The wonderfully fitted stones of great size at Sacsahuaman are natural boulders of diorite transported from afar and neatly joined together at the site.

★ NEXT MONTH IN SCIENCE DIGEST ★

RIDDLES OF THE NORTHERN LIGHTS

The scientific world has set itself to learn what lies behind the misty draperies of the auroras Telescopic cameras, radios, and rockets will all play a part.

MAPS AND MEDICINE

Why do some diseases hit certain localities much harder and pick on specific cities and countries, for no obvious reasons of hygiene? Medical world maps are helping to provide the answers

THE BIG SLEEP FOR ANIMALS

Now it's the time of the big sleep for the bees, the bears, the woodchucks, the snails, and many other animals Fascinating physiological changes make possible these months-long hibernations.

. . . and many other interesting, informative articles about science and the world in which we live

The largest-measured stone is 18 feet high, 36 feet long, and 6 feet thic·—in other words, approxi 4,000 cubic feet of extra heavy

Wendell Bennett expressed lief that the Incas moved thei ing stones on log rollers by

pry bars. It is also logically possible that, having invented the equal-arm balance for weighing things, they were able to lift great boulders by pivoting them from a lever counterbalanced by the cumulative weight of many smaller stones loaded into a sling or basket at the other end of the arm.

With such an "engine," they may have been able to "walk" great boulders to the building site and then hold them suspended until close fitting could be achieved. The loading and unloading of the smaller boulders and the resetting of the pivot pole would not be especially difficult.

It is astonishing that man performed most of his extra-heavy engineering at a time when he had not yet even harnessed powerful animals to do his bidding.

How thrilling it would be if we could but capture some of the ancient scenes and see in detail how the Peruvians, Egyptians, or Druids performed such prodigious feats that centuries of time have not been able to efface their work. Even a violent earthquake could not overthrow six of the massive columns at Baalbek in southwest Syria which are 62 feet high and 7½ feet in diameter.

Each consists of three blocks bound together with bronze pins. Travelers today stand speechless before their grandeur, powerless to explain how human hands could have put them in place.

Granting that the ancients who did this must have found a method of dividing the task into many small units of exertion, it still remains astonishing that the human spirit could be capable of such determination as to erect 58 of these gigantic columns around the shrine of one temple at this site. We shall do well not to forget these works even though we're in the era of pushbutton engineering.

Bees Have Built-In Clock

Parisian bees trained to feed at a regular hour in their Paris home showed up right on schedule for their sugar-water meal in New York.

In spite of the time-lag between Paris and New York, the bees, flown from Paris, kept to their previous 24-hour feeding cycle.

To Dr. Max Renner of the University of Munich who is conducting the experiment, this supports the idea that have a kind of internal "clock."

If the bees had changed their feeding time after the flight across the ocean, then it would have seemed that external factors, like the position of the sun, controls the bees' "time memory." This was not the case, however.

In the laboratory at the American Museum of Natural History, in New York, the bees fed from 3:15 to 5:15 P.M. This corresponds to 8:15 to 10:15 P.M. Paris time, the hours the bees were trained to feed.

Long-Distance Thermometer

Condensed from Industrial and Engineering Chemistry

HERE'S a way to measure the temperature of an ice cube a half-mile away at the North Pole. Probably, you've never faced this problem. However, if you ever run head-on into the problem of trying to determine a temperature at a distance, the new infrared pyrometers —thermometers sensitive to invisible light rays—may be the answer.

Apart from any possible use in frivolous studies of ice-cube temperatures in the Arctic, the new instruments show promise in a lot of fields. That's why industry and the military are so interested.

Prime advantage of the new devices is that, unlike ordinary thermometers, their temperature readings do not result from physical contact. This may be especially important where the material being studied is in motion, where it is inaccessible, or where it is corrosive, abrasive, or radioactive.

Although the older sort of light-sensitive pyrometers do take temperature readings at a distance, they ordinarily require that the material being measured be hot enough to glow brilliantly. In fact, conventional glass-lens pyrometers cannot take readings at temperatures much below 800 degrees Fahrenheit. Infrared pyrometers, on the other hand, work well in the full range from about 150 degrees below zero to almost 1,000 degrees above zero, and it is here that their greatest use is expected. The important point about them is that they are sensitive, not so much to visible light or radiation, as to radiation of a slightly longer wave length—in other words, infrared radiation, sometimes known as "heat rays."

Infrared pyrometer operation hinges on the fact that the infrared radiation of any material depends on its temperature As a result of skillful engineering design, the instrument is extremely sensitive to infrared. All you have to do is quickly pass your hand in front of the device (which, mounted on a tripod, looks somewhat like a large camera) and you can practically knock the recording needle off the scale

"You point this thing at the moon," says one company spokesman "and you get a heck of a wallop." Specifically, the instrumen n measure a temperature di small as 0 07° F. while

Industrial and Engineering Chemistry (Aug '55), 1155 16th St., N.W., Washington 6, D. C.

ings as often as ten times per second. At a distance of 3,000 feet, it can measure a temperature change of 0.2° F.

Heart of the infrared pyrometer is a tiny heat-sensitive flake composed of oxides of manganese, nickel, and cobalt, originally developed by the Bell Telephone Laboratories. It is what is called a "semiconductor" of electricity—that is, somewhere halfway between a metal like copper and an insulator like glass. The size of this flake, in comparison to the substantial bulk of the recorders, power units, and other equipment accompanying the radiation pyrometer is fantastically small —about 4/100,000ths of an inch thick and 4/100ths of an inch in length and width. The tiny platinum wires attached to the flake are so fine they must be handled under a high-powered microscope.

Infrared radiation striking the flake causes it to heat up. This, in turn, decreases its resistance to electricity. Changes as small as a millionth of a volt are amplified and picked up by the recording circuit. The fluctuating ink line of a recording pen can then be translated into temperatures.

Continuously, the infrared detector compares the radiation from the target with the radiation from a standard material. This permits an accurate, absolute determination to be made of the infrared radiation level of the target and thus accurate computation of its temperature.

Since stray radiation can cause us interference, care must be taken that the radiation falling on the sensing element comes only from the target material. The infrared beam reaching the sensing element is therefore only slightly larger than a pencil lead. Interfering visible radiation can be eliminated by use of optical filters provided as standard equipment.

As might be expected, the new equipment isn't exactly cheap. The least expensive model offered by Barnes Engineering Co. (until recently known as the Olympic Development Co.) of Stamford, Conn sells for $7,800, without recording equipment. The company's more versatile models have an even higher price tag.

"What we have now," explains a Barnes engineer, "is a precision research tool. What we will need for large-scale industrial use is a stripped-down model without all the 'bells and whistles.'" Another manufacturer of infrared pyrometers, Servo Corp. of America at New Hyde Park, N. Y., has units selling for as low as $3,850, which are designed primarily for industrial use.

Obviously, any new temperature-measuring device must stand up against close, possibly harsh, comparison with such relatively simple and cheap devices as thermometers. What then is the value of the new instrument? Where exactly will it be more effective than conventional temperature-measuring devices? Admittedly, manufacturers of infrared pyrometers don't have all the answers. They do, however, see some promising possibilities, in addition to

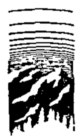
the secrecy-shrouded military applications.

A large magazine publisher, attempting to develop a new fast-drying printing ink, has found the infrared pyrometer valuable in measuring the temperature of the paper as it whizzes through the printing press. Previous use of other temperature-measuring devices for this purpose had given inaccurate results. In addition, Servo Corp. of America reports that infrared pyrometers have been used successfully to measure the temperatures of rotating bearings and brake drums. Mounted along railroad tracks, these instruments are being tested for use in the detection of local overheating in the bearings of passing trains.

For the manufacturer of large vacuum tubes for radio transmitters, the device can determine accurately the temperature of the heated elements while the gas is being drawn out. Too high a temperature could quickly wreck a $10,000 tube For the producer of machine tools, the instrument gives important information on the heat developed by cutting tools during use If thermocouples (a kind of thermometer which measures heat electrically by direct contact) were attached near the cutting edge, they might be torn to shreds by the flying metal chips. Furthermore, compared to a thermocouple, which may take one or two seconds to respond to an appreciable temperature change (a thermometer may take even longer), the new instrument makes its response in only two or three thousandths of a second.

In the chemical industry one company has found the device effective in locating hot-spots in the outer surface of a catalytic cracking tower. The instrument might also be used to detect hot-spots in furnaces, calcining drums, and other industrial equipment.

Infrared pyrometers are currently being used by two leading chemical firms to measure the temperature of sheets of plastic film rapidly undergoing fabrication, while a similar use in the manufacture of rubber is now being tested. Of special future importance, applications for these instruments are bound to expand with the advance of automation



THE APPALACHIAN MOUNTAINS which rise to a supreme elevation of 6,684 feet at Mt Mitchell, may grow some more according to Princeton Prof William E. Bonini. He says gravity research has indicated that mountains have roots and that ranges "float like icebergs, with only a small part above water, or the land surface and much beneath. Gravity measurements show that the Appalachian Mountains are too small for the size of their roots, that there is more root than the mountains should have," Prof Bonini reports. "They have risen through the centuries to at lea different levels and we can predict another rise although not for centuries "—*The New York Times*

Eight Million Get Polio Protection

Nearly eight million children in the United States, Canada, and Denmark have received the poliomyelitis vaccine without harmful effect.

"This," declares Dr. Thomas Francis, Jr., University of Michigan director of the Poliomyelitis Vaccine Evaluation Center, "provides additional assurances that accidents are the exception, not the rule."

Editorializing in a special issue of the *U-M Medical Bulletin* devoted exclusively to poliomyelitis, Dr. Francis also expressed the opinion that as a disease problem, poliomyelitis has not been over-emphasized. Because the case load has jumped to between 35,000 and 50 000 a year, he said, he does not believe that the battle against the disease has been exaggerated.

"The fact that other diseases are more prevalent or more severe only indicates that they too need adequate investigation looking toward control."

Test Air Raid Home Warning Devices

Almost every home in the United States may have an indoor alarm system installed in it to warn of an impending air attack.

Civil defense engineers are trying to perfect an indoor warning system that will successfully compete with dish washers, crying babies and television. Outdoor sirens are effective alarms, but civil defense planners are concerned because many people at home often cannot hear the warning wail

Three systems of indoor warning are now being evaluated and tested: electric power, telephone, and radio.

Most promising of the systems for reaching the greatest number of Americans with equipment on hand is the use of electric power. An indoor system based on transmitting signals over the electric power transmission lines might ·vably reach 99 percent of the population in homes with electricity One signal could be sent out to all electric power customers from a relatively small number of power stations.

One such use of electric power would work in this manner: A small reed, tuned to go off as an alarm at a predetermined frequency, would be installed in each home. When an atomic or hydrogen bomb attack is imminent, the power station would change the frequency of power output and the reed would sound the alarm.

Another possibility for warning home dwellers is the use of the telephone All phones throughout the country could be rung simultaneously for several seconds or a minute. The rings would be in code form, the same as the outdoor siren wails.

—Howard Simons in Science News Letter

THOSE AMAZING ISOTOPES

by David O. Woodbury

Condensed from a chapter of the book, Atoms for Peace

EARLY IN 1946, a converted war-research reactor began turning out a trickle of radioisotopes that [illegible]

92 natural elements and 2 man-made ones, neptunium and plutonium. A considerable number of variations on them were already known, mostly stable, some the artificial products of earlier research with the cyclotron. Now, suddenly, the neutron atmosphere available in the piles could add many hundreds of new isotopes to the list.

For reasons still not entirely understood, nature has limited the variety possible to each element. Each has, by definition, a certain number of protons of positive charge, maintaining an equal number of electrons of negative charge. Some of the electrons account for an element's chemical properties.

Each atom is rounded out by a quantity of neutrons, and nature tolerates a variation in this quantity, thus allowing a number of isotopes to each element. The isotopes of an element have slightly different atomic weights and different degrees of radioactivity, or none at all. Otherwise they are identical. Nature has apparently not bothered to make most of the possible radioisotope[illegible] else did so at the beginning [illegible] them all.

Atoms for Peace, copyright 1955 by David O. Woodbury and published at $3.50 by Dodd, Mead & Co., 432 Fourth Ave., New York 16, N. Y.

Thus we have sodium with a single natural isotope, gold with only one, iron with four, mercury with seven and tin with ten. The reason there are no more is that only these configurations are stable enough to survive. An analogy would be a triangle of billiard balls pushed close together on a table. The three will lie there indefinitely. A fourth can be added on top; the pile will still remain, though its stability is less. But we cannot add a fifth; there is no place for it to rest.

By adding neutrons the number of isotopes of an element can be increased. The great majority of these are partially unstable, that is, radioactive. By throwing off alpha or beta particles or gamma rays, or combinations of them, they consolidate themselves into stable isotopes or transmute into isotopes of near-by elements, either stable or still radioactive. The heavy elements do this spontaneously, without man's tinkering. Uranium, for example, becomes lead after 14 generations, of which radium is the 6th.

A salient feature in all this is that every radioisotope has a specific rate of decay. When half of the atoms in any sample of an element have undergone change, one half-life is said to have passed. During the next half-life period, half of what remains will have changed, and so on. The activity of the sample, therefore, fades away according to a definite descending curve. After ten half-lives a radioisotope's activity is down to about 1/10th of 1 percent. That is, it produces only 1/1,000th as many disintegrations per second as it did when we first considered it. There is no known way to alter the half-life period. It is a fundamental constant of nature.

The great discovery quietly made during the bomb rush was that man could fashion hundreds of radioisotopes at will, and that these would be of transcendent value in scientific research because they could be located in a much larger quantity of the parent element by radiation counters.

Adding neutrons to a small sample of sodium or gold or phosphorus meant that you could find it wherever it went, and so identify what part the element played in a vast number of chemical reactions

The discovery was not as clear-cut as it appears, but a matter of new mass-production methods. For years the cyclotrons had been making microscopic quantities of radioisotopes at huge expense. Now, with neutron densities of a million million per square centimeter per second (an average level in an atomic pile), any element placed in their path would be quickly enriched in one or more radioactive forms. The great importance of pile-made isotopes was that they could be made in considerable

DAVID O. WOODBURY is an engineer, a writer and a traveler. He has contributed widely to many national magazines, is re-

quantities and at very little expense.

The pile at Oak Ridge held the honors in isotope-making for some years. Today there are other manufacturing centers. The giant at Brookhaven is by far the largest; there are also isotope producers at Argonne. Some isotopes are made, also, in the materials-testing reactor at Arco, Idaho. North American Aviation in California is the first private group to build and operate a 'neutron source", it has turned out two, one of which is helping the oil industry in petroleum research at Livermore, Calif. And in Canada, Chalk River carries the burden. The probability is that we shall soon see these isotope-makers spotted all over the United States

Since half-lives range all the way from millionths of a second to billions of years, production and use cannot be entirely standardized. Some of the most important isotopes have unfortunately short life spans and must be put to work at once. At the University of California, scientists had to snatch treated samples from the cyclotron and carry them at a dead run to the laboratories Brookhaven's first real business came in supplying radiosodium to the Harvard Medical School. Taken from the pile at 6 A.M., shipments were flown to Boston by private plane and put to use before noon.

Radiosodium (usually in salt) has a half-life of 14.8 hours, which makes it safe to administer to patients both for treatment and diagnosis Radiogold is half gone in three days, potassium and copper in half a day. All of these require special transportation to get them on the job in time. Cobalt-60, on the other hand, halves its radiation in five years or more, so that it can be packed and shipped at leisure.

Today, most of the critical isotopes go by plane; if the distance is too great they cannot be supplied at all.

Practically any element can be made radioactive in a pile, simply by sealing it in a small aluminum container and pushing it into a duct within the neutron atmosphere. A highly organized system of remotely-controlled handling permits the material to be treated at a known intensity and for a known time. In some piles pneumatic tubes blow the containers in and out. At Chalk River, samples are packed in metal balls and rolled into the pile by gravity. All handling is done in such a way that operators can work steadily without receiving radiation

• The challenge of tomorrow fascinates me much more than the achievements of yesterday —David Sarnoff

At Oak Ridge the procedure is on a mass-production basis, and all material is treated on a once-a-week schedule. The pile must be shut down to load and unload, so its work is scheduled in weekly cycles. This results in standardized radioactivity, each element coming out wi usual strength.

When a run shuts down, t tainers of new isotopes ar drawn with long rods into h

"pigs," and are stored. Another department is constantly busy, packing and shipping. When a laboratory orders, say, a curie (the standard measure of radioactivity) of radiostrontium, the material is taken out of storage, diluted to the right strength, and packed in lead for shipment. The type of activity determines how much shielding is necessary, according to Interstate Commerce Commission rules. If the isotope is an alpha or beta emitter only, little shielding beyond the shipping carton is needed. If it is a gamma emitter, lead is necessary, sometimes tons of it, where hundreds or thousands of curies are involved. Yet the actual amount of active material may be as little as 1/100th or 1/1,000th of a gram.

In its big brick-and-steel factory called X-10, Oak Ridge produces mostly long-lived isotopes, which are flown to their destinations by commercial airlines, sometimes carried by express. Along with nearly half of the nation's output of U-235 for bombs, Oak Ridge also manufactures a small amount of non-radioactive isotopes in the old electromagnetic separation plant, Y-12. These are used in basic research where radioactivity would interfere with delicate measurements. As tracers, they can be detected by analysis in a mass spectrograph. The Brookhaven pile has internal ducts so arranged that material to be converted goes through along a continuous loop. The cans of mater...

can is always known. By moving the whole line around, any sample can be removed at will. Thus, high or low activity can be given to it, and delivery can be made as soon as it is ready. The pile need not be shut down to load and unload.

Brookhaven makes shipment mostly to the Atlantic seaboard area to hospitals and university laboratories. These are either delivered by car or plane. On a typical morning a shipment, say, of radiosodium in a compact little lead pot—it is a gamma emitter—is called for by Connie Schmidt, who has the contract for handling Brookhaven isotopes. Schmidt takes it to La Guardia Airport, 60 miles away, and sees it onto a plane, maybe for Boston. It is met at the other end by a truck from some hospital and is in the laboratory at work before noon.

While this is the history of the common isotopes like sodium, potassium and phosphorus, there are many demands for specialized products, usually not in the chemical form produced in the pile. In such cases the raw material will be sent on to special manufacturing companies such as Abbott Laboratories or Tracerlab. Here, the radioisotopes are
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›e given a special location in the nolecular structure — very impor- ant in hydrocarbon studies.

Whatever the isotope or isotopic compound, it is delivered to the customer at a definite energy level A tag fastened to the container tells what it is, mentions its half-life and gives the curie level of activity as of a certain date.

It is the fate of the radioisotope to ‧‧ continually checked for activity. l through its life it is subjected to unter tests. In the pharmacist's boratory you see half a dozen measring jobs proceeding at once, each alled in by a castle of thick lead ricks. After use the isotope is atched and accounted for till it nally dies.

One might think that the shipping if dangerous isotopes by common arrier would be a difficult thing, but t has not turned out to be. At first, package handlers were alarmed when they read the labels and thought of the bomb. Nowadays nobody pays much attention to isotopes; regulations are so strict that there is no more radiation outside the container than from natural sources in the surroundings. About 100,000 particles from cosmic rays and earth sources pass through your body every hour. Strays that penetrate shipping containers are much fewer than this.

The majority of radioisotope shipments go on a preferred basis, by air express. In England a great deal of expense is saved by carrying the stuff in a little well in the wing tip of the plane, with no shielding at all. The shipments are handled by trained men who use long rods to keep away from the field of danger. Wing tips are far enough away from passengers and crew to prevent radiation hazard.

At present, with AEC in complete control of the radioisotope business, very rigid regulations for handling and use are maintained. No doctor or laboratory group may buy them unless they can show that they have sufficient training and experience. The price of isotopes is very low—hardly more than the cost of manufacture and handling, with nothing added for the gigantic investment in equipment.

Interest is growing in the small, privately-owned reactor that can make isotopes in small amounts, doing research at the same time. Already the University of North Carolina has such a pile; Penn State has one on order; M.I.T. has announced plans for one. AEC welcomes these small, privately-owned machines, paid for by the owners, who get subsidies from the government for carrying on research. They pay off to the nation in many ways, among them by teaching nuclear engineering and physics, thereby increasing the number of atomic experts for tomorrow.

THE STEEL INDUSTRY consumed more than 34,000 tons of aluminum in steelmaking operations during 1954, according to the American Iron and Steel Institute. The lighter metal is used as an alloying element and to remove oxygen from steel.

a special location in the structure — very important in hydrocarbon studies.

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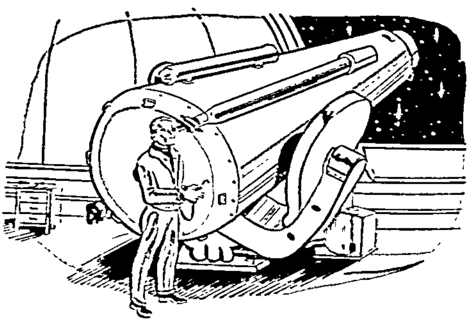


SKY ATLAS MAPS THE HEAVENS

by *John Oliver La Gorce*

Condensed from The New York Times Magazine

SOME 1,800 YEARS AGO the Alexandrian, Ptolemy, in his great astronomical work, the *Almagest*, listed the positions of 1,022 stars in the sky. Century after century since then, man has pushed his frontier of knowledge farther into the heavens, ever reaching out for the unknown.

Now, Palomar Observatory, the National Geographic Society, and the California Institute of Technology are completing a seven-year project that extends that frontier 4,000 billion billion (4 followed by 21 zeros) miles out into the universe. To span so much space, light from incredibly faint celestial bodies, dashing 186,000 miles each second, must travel for 600 million years. In contrast to Ptolemy's 1,022 stars, the survey's new *Sky Atlas*, the most extensive and detailed in history, reveals so many billions of heavenly bodies that they may never be counted.

The *Atlas* maps a volume of space at least 25 times as large as ever before charted. Most of this vast region, far beyond our own solar system and home galaxy, has not even been seen before by astronomers. For many decades to come the

map will point the way to new worlds in space.

Actually there are telescopes capable of probing even deeper than the new survey's 600 million light years. The giant 200-inch Hale Telescope at Palomar, for instance, reaches nearly two billion light-years. But its field of view—about one-fourth the area of the full moon—is so narrow that it would take perhaps 10,000 years to cover the sky.

The telescope that made the survey posible stands under a separate, smaller dome at Palomar. Known to astronomers as the Big Schmidt, it is actually a gigantic wide-angle camera; its aperture lens measures 48 inches across and its reflecting mirror is 72 inches wide. It is named for its inventor, the German optical genius, Bernhard Schmidt, who devised a lens capable of photographing very large areas of the sky with virtualy no distortion of the image

This wide "eye" to the stars captures on a single photographic plate a sweep of sky equal to 200 full moons, or as large as the bowl of the Big Dipper. At the same time it records all stars down to a brightness of one-millionth that of the faintest star the naked eye can see. It could catch the gleam of a candle 10,000 miles away.

When tests on the Big Schmidt were completed, Dr. Ira S. Bowen, director of Palomar and Mount Wilson Observatories, began listing all the projects his astronomers hoped the new telescope could carry out. It would have taken years to get through the list. So it was decided to tackle the largest goal first—the entire sky. A definitive atlas of the heavens would embrace all the other projects the Big Schmidt was being asked to do piecemeal. It would offer the telescope's unprecedented scanning power to astronomers all over the world. It would point the way for the giant Hale Telescope, scouting the sky for objects to be studied more closely.

It was calculated that the expanse of sky to be covered—all that can be seen from Palomar, about three-fourths of the celestial sphere—could be captured on about 900 photographic plates, each 14 inches square, with the fields overlapping slightly Because stars emit light of different "temperature" or color, it was necessary to make two plates of each sky section, one with a blue-sensitive emulsion and the other with a red-sensitive emulsion. These had to be exposed in quick succession, to be certain they showed the sky in nearly identical states. Each plate had to be exposed from ten minutes to an hour, the reds longer than the blues, to soak in the faintest light rays coming from deep in space and time

The astronomers discarded man plates—more than they acce the early months—becaus scopic flaws in emulsi

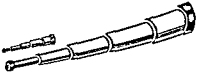
John Oliver La Gorce, president of the National Geographic Society, was a representative of the Society on a committee that supervised the seven-year sky mapping project nearing completion at the Palomar Observatory

MAPPING the SKY

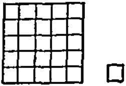
Ptolemy, ancient Greek astronomer, some 1,800 years ago listed the positions of 1,022 stars.

The new *Sky Atlas* reveals so many billions of heavenly bodies that they may never be counted.

It extends the frontier of man's knowledge 4,000 billion billion miles out into the universe . . .



. . . and maps a volume of space 25 times larger than was ever before charted.



The *Atlas* will include 1,758 prints, two each for the 879 separate sections of the sky. Only about 100 copies will be prepared. Cost, each $2,000.

cus, or any slight blurring of the star images caused by motion during exposure or by disturbance of the atmosphere above Palomar. There were months, and even entire winters, of abnormally bad "seeing." But year by year, slowly—often frustratingly slowly—the squares on Sky Survey's master plan were marked in as completed. In the end the survey took seven long years instead of the four originally planned.

Now the priceless original plates are locked three floors below ground in Pasadena and a duplicate set will be safeguarded deep below the huge dome of the Hale Telescope on

Mount Palomar. The first volumes of prints are being sent to observatories, universities and scientific institutions around the world. More volumes will follow. The completed *Atlas* will include 1,758 prints, two each for 879 sections of sky. Laid out flat, they would cover a tennis court Only about 100 copies are being printed—at a cost of $2,000 each.

The work is so comprehensive and of such vast usefulness to further exploration that, as one scientist put it, "It is as if Columbus were bringing back aerial photographs of all of North America from his first voyage in 1492."

Already the new *Atlas* has revealed things about the cosmos we never knew before. New comets, near neighbors of the earth, have been found. One faint wanderer circles the sun in only 2⅓ years, a short roundtrip compared to most comets. Tiny asteroids, mountain-sized chunks of rock, have been spotted on *Sky Atlas* plates, flying through the solar system like baby planets One cuts across the earth's orbit. Although six others like it are known, astronomers say there is scant likelihood any of them will ever collide with the earth

Astronomers have long known that our sun belongs to a huge aggregation of from 200 to 300 billion stars: a slowly turning wheel called the Milky Way. In modern times, they began finding others like it, other universes of stars, dust and gas called nebulae, or galaxies. The *Sky Atlas* records literally hundreds of millions of these . Some are flat and round, like ours, with arms spiraling out as from a Fourth of July pinwheel. Others are egg-shaped or spherical.

Sometimes galaxies form clusters, great archipelagoes of stars. Before the Sky Survey began, a scattering of fewer than 40 such clusters of galaxies were known to astronomers. Now about a thousand have been mapped. More may be pinpointed as scientists study the *Sky Atlas* plates in the years to come.

Not only are new clusters being discovered, but also hints that there may be clusters of clusters. So many large aggregations of galaxies have been recorded that Palomar's sky explorers are considering the possibility of a new general rule of nature —stars form into galaxies, galaxies into clusters, and clusters combine into still larger groups.

The hundreds of newly-discovered clusters already are providing new yardsticks to the distant edges of man's vision The distance to a galaxy often can be learned when it lies in a cluster; then the average brightness of the cluster is a reliable guide to how far away the system is There are now strong indications that distances to other galaxies are two and three times as great as previously thought

Recently the new science of radio astronomy has been investigating radio signals coming from many parts of outer space. One of the to which the *Atlas* has put is to identify the mysterious signals. P omers, using survey

identified some of them as coming from galaxies in collision.

But if the *Sky Atlas* has already furnished astronomers with some new facts, its great usefulness still lies ahead, in decades of systematic research into still unanswered questions.

For instance, some stars suddenly explode into greatly increased brilliance. These are the "novae" and "supernovae," the latter hundreds of millions of times brighter than our sun. Already at least one new supernovae has been discovered by comparing a suspected galaxy with the Sky Survey map of that section of the sky, made two years before.

By revealing such a star's color, temperature and brightness, the *Atlas* can perhaps point to the cause of the flareup and show astronomers what types of stars are most likely to explode.

One of the greatest questions confronting astronomers today is whether the entire universe is constantly and rapidly expanding. A quarter of a century ago it was found that distant galaxies not only seem to be speeding away from us, but *that the farther away they are the faster they appear to recede*. The clue was a shift in the spectrum of their light rays—the so-called "red shift." If this direct relationship between distance and speed should hold true in all parts of space, it would mean that the entire universe is exploding.

To test the expanding-universe theory, however, requires that more more distant galaxies be found and their spectra measured. The Sky Survey has done the first part of the job; it has located the galaxies. The 200-inch telescope is now photographing them to determine their red shift. So far, clusters of galaxies have been found to be receding at speeds of more than 38,000 miles a second, a fifth of the speed of light itself.

If all distant bodies actually are rushing away from each other, does this mean they all came from a common center in some cataclysmic "birth of the universe"? If so, it should be possible to calulate backward and learn how long ago it all began. Calculations based on the red shift indicate the age of the universe at some three to five billion years. This agrees with scientific determination of the age of the earth.

Red shift, of course, may not mean that the galaxies are rushing away; it could be the result of some as yet unknown law of light or rule of the universe. If so, the *Sky Atlas* may help astronomers to unravel the mystery.

It will also help to determine whether the universe can ever be explored entirely. If the universe is expanding at an ever-increasing rate there must be a point at which celestial bodies begin racing away faster than their light can return. Such bodies can never be seen by man, no matter how powerful the telescope he builds.

Thus the Sky Survey may point toward an ultimate, uncrossable barrier to man's visual probing of the unknown.

when the AVALANCHES roar

by R. A. Braun

THE KNOWLEDGE of avalanches and their dangers is almost a science in some parts of Europe, but in the United States — a newcomer among the winter-sports nations — relatively little is known. Actually, no mountain chain in the world is safe from this danger Avalanches have killed people in the mountains of Japan, on Mount Everest, in the wilderness of the Russian Caucasus, and even in the mountains of the Mediterranean Island of Corsica.

The people of Switzerland and Austria know only ι ʰhat can happen in so-called safe places. More than 10,000 snowslides occur every year in the European Alps, thundering down on sleeping villages and resort places, peasant homes, hotels, railroad stations and churches. The winter season of 1951 was one of the worst in the Alps' history, about a hundred persons and more than a thousand head of cattle perished, thousands of houses and about 3,000 square miles of forest were destroyed

Despite the fact that Switzerland spends millions to make railroads, towns and forests safe from the crushing snowslides, new tragedies make headlines every year. Yet, in many places the snowslides have been checked.

At the fashionable ski resort of Pontresina, where every winter a dangerous avalanche thundered down through the center of the village, its fury has been defeated by man-made constructions which fend off the snow.

The North American Continent has its own avalanche stories—not as many as the Alps—because our mountains are much less populated Yet, in 1910, for instance, a snowslide thundered down on the little town of Wellington in the Cascade Mountains and threw the whole railroad station with three locomotives, several coaches and a water tank into a deep canyon, killing o

At Telluride in the R tains, a snowslide tore ed boarding house and the tenants.

In Alaska the air

avalanche alone tossed a row of houses 50 yards uphill and destroyed them.

A number of skiers and mountaineers have lost their lives in our western mountains because of ignorance about the threat of avalanches. Last summer seven American boys were killed by a snowslide near Banff.

Experts know various types of avalanche, and they can give special advice for almost each one of them.

Strange as it may seem, getting caught in a snowslide does not mean certain death — persons buried in avalanches have managed to stay alive for days. The most famous case occurred in *1951 near the little town* of Heiligenblut in the Austrian Alps, where a man named Gerhard Freisegger was dug out alive after 12 days. Even though he lost his feet because of gangrene, he is still alive.

Anybody who ventures to leave the beaten path of winter resorts should know a few simple rules—they might save his life. One of the first rules is, never to play the lone wolf in an unknown territory. Another, never to go on a long ski trip without an avalanche string—a thin red rope about 25 yards long, to be slung around the waist and dragged along by everyone in the party. The string gives rescuers the best chance to spot a man buried in the snow.

Everybody should, of course, take the natural precaution of asking the experienced ski instructors, forest rangers or inhabitants about snow conditions before leaving on a trip. One should not start such a trip during or after a heavy snowfall. These are the most dangerous times, and the later it is in the season, the more dangerous the snowfalls become.

The days after a storm are the times when the "sun-awakened avalanches" move down the slopes—sometimes at the slightest noise—a loud word for instance. It takes the snow at least two to three days to settle down and to become — to some extent — safe once more.

Those who dare to disregard *such conditions* put themselves in the same position as a ski party of three boys and a young girl whom I met years ago in the Tyrolean Alps. They showed all the pathetic ignorance of beginners and tried to reach a ski hut high up in the Silvretta during a heavy snowfall. Everything seemed all right to them, *in spite of many warnings.*

"In this soft snow nothing can happen," they said scornfully when an angry guide tried to block their way, and on they pushed. *Twenty* minutes later they were killed by an extremely heavy ground avalanche and it took a week to recover their bodies. They did not know that there is nothing soft about snow in an avalanche.

Nearly everybody on skis sur-

Measure Boiling by Singing of Kettle

Scientists are catching up with what housewives have known a long time: you can tell about how hot a kettle of water is by listening to the sound of its boiling

In experiments to relate the sounds of boiling with temperature and the flow of heat from heater to liquid, three University of Illinois chemical engineers, J. W. Westwater, A. J. Lowery, Jr., and F. S. Pramuk, boiled methyl alcohol at 148 degrees Fahrenheit, using a copper heating unit—and listened to what resulted.

They found that there are three separate stages in boiling, each with its own typical sound pattern — depending on the difference in temperature between the liquid and the metal heater (in the kitchen, the bottom of the water kettle)

First came "nucleate boiling" with systematic bubble formation at specific spots on the metal surface. This kind of boiling ceases when the temperature difference between liquid and heating surface is 85° F.

From that temperature up to 130° F. difference comes "transition boiling," when bubbles form violently and at random over the copper heater. The boiling sound increases rapidly across the transition temperatures.

Beyond 130° F., lies "film boiling," when the hot metal is blanketed in a film of vapor and the sound level is rather uniform.

The experiments were reported in the journal, *Science*.

Farming Boom Predicted

Another revolutionary step forward in farming—like the one that came with the use of hybrid corn varieties—may be in the offing, as newly developed grain sorghum hybrids are readied for commercial use.

Holding great promise as superior feed crops for semi-arid lands that cannot grow corn efficiently, the sorghum hybrids are expected to produce 20 percent to 40 percent more grain per acre than varieties currently used. This stepped-up yield equals the gain to farmers in their switch from old corn varieties to hybrid corns.

The U. S. Department of Agriculture predicts that most of the nation's sorghum acreage, over ten million acres last year, will be given over to sorghum hybrids within five years.

Grain sorghum, like corn, is a member of the grass family. Unlike corn, though its grain grows at the top of the plant. Both the grain and stalk are used as livestock feed, the grain used directly and the stalk being processed as silage. Recently, sorghum grains have become a vital source of food products such as starch and dextrose.

The new hybrids are largely the result of work done by the U.S.D.A.'s Agricultural Research Service and the experiment stations in Texas, Kansas, Nebraska and Oklahoma.

"HOT DOGS" IN THE LAB

by Harry M. Schwalb

Condensed from The Laboratory

IN 1939 the hot dog hit the front pages of the international press when President Roosevelt's wife served it to the king and queen of England And as 1955 draws to an end, Americans, by devouring over 8½ billon tangy "red hots," have made the frankfurter or wiener (formulation's the same, though the wiener is a bit shorter) a major phase of the meat industry, outranking everything but ice cream in popularity on the national menu

Few people realize that the humble frankfurter (which got its official name when a German butcher popularized it in Frankfurt a century ago) was commonplace 1,000 years before Christ; fewer still are aware that it has finally arrived in the transforming halls of the modern laboratory

For example, in the American Meat Institute Foundation laboratories on the University of Chicago campus, you can watch bacteriologist Eileen Felton and physicist William Powers create a genuinely *hot* hot dog They stuff the frank into a metal "bun," lower the sample into a cobalt-60 furnace, and study the effect of gamma radiation on the processing of the foodstuff.

When atomic sterilization is perfected to the point where the franks maintain the desired ruddy color develop no side flavors or od food industry will have an new method of preparing f long-range non-spoilable k

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soldiers and civilians the world over.

In still another Foundation laboratory, scientists study not the new techniques but the traditional ones (smoking franks to an internal temperature of 155 degrees Fahrenheit for two hours). And in their laboratory-sized smokehouse, chemists control the gas velocity, flow direction, temperature, humidity and smoke density with amazing delicacy.

From even the miniature lab smokehouse it is a tremendous jump in scale to the bench of histologist Hsi Wang, who uses a "micromanipulator" with his microscope to segregate the components of a single bacterial cell. Bacteriology is an important part of hot-dog science since the organisms that attack frankfurter surfaces, though non-toxic, are unusually cantankerous: they're not only unafraid of the heavy salting that frankfurters get, they actually grow in media containing 10 percent salt. These bacteria produce hydrogen peroxide; while this turns brunettes into pretty blondes, it turns the ruddy frankfurter surface into a non-marketable green. These "greening" epidemics have been probed by frankfurter biochemists who, through their directions as to plant cleanliness and new smoking-room temperatures, just about have the intruders licked.

Supermarkets have boomed the success of the hot dog; they have also introduced a new problem: the intense artificial light of the retail counter The problem initiated the study of meat pigments and what [illegible] to them during processing, during exposure to light, and in the presence and absence of oxygen. Chemicals like disodium phosphate and ascorbic acid may solve the problem once and for all.

Frankfurter casings are still another lab achievement. For years, sheep and hog casings from China, Russia, and Australia were used, despite the fact that no genuinely clean, hole-free and uniformly-calibrated sheaths could be obtained A fellowship was set up at Pittsburgh's Mellon Institute with the object of devising an edible synthetic substitute. For ten years, chemists investigated all edible film-forming materials—gelatins, casein plastics, agar agar, algin, starches, cellulose.

Selecting cellulose, they next had to find a way to eliminate that still "papery" quality. After experimenting with every known softening treatment, they created an untreated soft, pliable film merely by making the film ultra-thin. Today, "skinless franks" outsell the other kind.

Until recently, little data had been developed on the nutritional properties of the hot dog; the thing was such a pleasure to eat, it was almost too much to expect that it could be good for anyone, too. Especially unknown was the proportional nutrient-loss due to processing.

So, biochemists descended on retail stores in Chicago, scooped up samples, subjected them to hundreds of analyses. Result: the hog dog has been shown to be as adequate a source of 18 essential amino acids, plus thiamin, riboflavin, niacin and iron—as fresh beef, pork and lamb.

BIRTH of NEW STARS

DOCTOR George H. Herbig, associate astronomer in the University of California's Lick Observatory, recently raised the possibility that he may have detected the "birth" of two new stars

If confirmed, the event will have been truly unique in the history of astronomy

Doctor Herbig reported his findings in a paper delivered to a meeting in Dublin, Ireland, of the International Astronomical Union

THE DISCOVERY of the possible "birth" of the two stars is based chiefly on two types of evidence.

First, Dr Herbig has taken two photographs seven years apart, of the same point in the Orion Nebula In the first of these photographs, taken in 1947, there are three stars imbedded in a dark cloud of dust and gas In the second photograph, taken in 1954, five stars appear where there were only the three in 1947.

Second, Dr. Herbig and other astronomers have been accumulating evidence during the past decade that all five stars belong to species that have been formed recently.

Doctor Herbig's research began as a result of a pioneering paper published by Dr. Alfred H Joy, of the Mount Wilson Observatory, in 1945. Dr. Joy cited the existence of peculiar types of stars which were always associated with dark clouds of dust and gas between the stars

SINCE that time a number of astronomers, including Drs Joy and Herbig, have studied these stars and their relationship to the dark gas clouds in which the stars seem to be imbedded like raisins in a pudding These stars often cause the gas to glow in their immediate surroundings They are luminous objects, but do not appear very bright to us because of their great distance They are so rare that few of them are in the solar system's stellar neighborhood They were named T Tauri stars since the long-known star T in the constellation the Bull, is of this type.

The association of the stars with gas clouds

these stellar objects had been formed out of the condensation of material in the gaseous streamers

GOOD EVIDENCE was slow in coming. Now Dr. Herbig says that the evidence, which he and other astronomers have gathered, strongly favors the idea that the T Tauri stars are newly-formed objects. He pointed out that the T Tauri stars give more energy for their mass than other stars that have been in existence for several billion years. Moreover, they rotate at greater speeds. Their distribution and their spectra also argue for recent birth.

Doctor Herbig's 1947 photographs of the three stars in Orion became significant in this picture because the spectra suggested, in the light of subsequent data, that the stars might be younger, or "infant," T Tauri stars.

When the 1954 photograph showed the existence of two more stars than had existed in 1947 and a brightening in magnitude of the three original stars, Dr. Herbig felt he was forced to consider the possibility that the birth of two new stars had been observed. The strange new stars in Orion may be "baby" T Tauri stars.

OUR UNDERSTANDING of what is taking place could hardly be more incomplete," said Dr. Herbig cautiously, "but it may be that we have witnessed the opening phase of an episode in stellar evolution."

The findings may provide important support for the idea of a continual birth of new stars, and help to explain how they are formed.

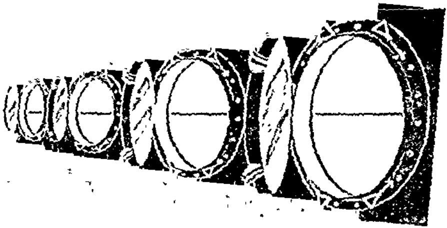
The actual birth of the two new stars would have occurred, of course, about 1,600 years ago—the time it takes for light to travel from the Orion nebula to the earth.

New Research Rocket To Soar Up 180 Miles

A new research rocket designed to carry 150 pounds of scientific instruments 180 miles into the air at one shot was described recently by John W. Townsend, Jr., of the Naval Research Laboratory, Washington, D. C. The 180-mile altitude is expected to set a record high for a single-stage rocket.

Twenty-two of these Aerobee-Hi rockets will be fired at Fort Churchill, Canada, during the International Geophysical Year in 1957-58, Townsend told the American Rocket Society. Their cost is only 1/10th that of large Viking rockets.

The Aerobee-Hi rockets will be pressure-sealed so that samples of air taken high in the atmosphere will not be contaminated by gases leaking out of the rocket. Such leakage, Mr. Townsend said, has spoiled all measurements of this kind from Viking rockets, since they were literally flying in a cloud of their own gas—created by air escaping from instruments and from boiling liquids.



IS THE OCEAN GROWING?

by Gerald Ames

IF OUR PLANET were finished to the last detail, it might be futile to wonder how the ocean formed and whether it is growing or shrinking now But creation is still going on A few miles beneath the surface, rock stirs mightily, melting and freezing and melting again. Water driven from the depths adds continuously to the sea. Unless it loses water at an equal rate, the ocean must be growing It now covers 71 percent of the earth, and who knows how great it will be in the future?

Some of the earth's internal water reaches the surface through volcanoes In the spring of 1902 the mountain called Pelee, on the island of Martinique, began to show signs of life Everyone knew it was an old volcano, but it had been quiet for so long that trees grew in the basin-shaped crater on its summit. People came there on outings from the city of Saint Pierre, a few miles away One morning a vent opened in the crater floor, and from it a plume of white vapor rose over the mountain Water poured from the vent for several days, filling the crater Then explosions breached the crater wall and released a deluge of mud down the mountain

Chunks of lava, heaved up by the volcano, built a dome over the old crater floor. Two weeks after the beginning of all this activity, an explosion sent a jet of lava spurting from one side of the dome. The frothing mixture boiled down the mountain, and steam bursting from it rolled in a hot cloud over Saint Pierre. In one minute the entire population of 30,000 was scalded and suffocated to death.

On Hawaii, vapors rising from lava lake of Halemaumau tapped and analyzed, and the

age water content of several samples was found to be 68 percent. The Mexican volcano Paricutin, according to an estimate made in 1948, emitted steam at the rate of 16,000 tons a day.

Long after volcanoes have stopped erupting, the half-liquid rock beneath them continues to yield water vapor and other gases. Steam may puff to the surface through holes or vents or water may well up in hot springs. Much of the flow is groundwater heated by vapors, but some of it comes from the underlying melted rock, or magma. Geologists have estimated that as much as 13 percent of Yellowstone hot-spring water is magmatic.

If a piece of glassy volcanic rock is heated to melting, it bubbles a little, then flashes into foam. The froth is pumice, the stuff that is picked up around volcanoes and is used for polishing Sometimes, after an eruption of an island volcano, pumice floats on the sea in great drifts.

Pumice is produced by gases, chiefly water vapor, bubbling from liquefied rock. Water is an ingredient of all volcanic rocks. Tests have shown that some of them contain as much as 10 percent water. Scientists have taken this fact into consideration in speculating on how our planet and its ocean originated.

GERALD AMES' books on geological themes include *Restless Earth*, published by Abelard-Schuman in 1954, and *Story of the Ice Age*, scheduled for publication next spring by Harper & Brothers.

Today's theories of creation start from the idea that the earth and other planets developed in the course of the sun's evolution. Originally, it is supposed, the material for the solar system was a huge flat cloud of gas and dust, slowly rotating. Gravitation pulled matter toward the center, where the sun was formed. The cloud continued its motion, turning around the sun like a great wheel. It consisted of typical cosmic matter, with the elements hydrogen and helium most plentiful. The dust was largely compounds of iron and compounds of silicon.

The rotary motion of the cloud, as pictured by the physicist Weizsacker, caused it to break up into whirlpools that circled the sun in several orbits The edges of whirlpools in neighboring orbits brushed against each other and rolled up denser eddies of matter. Some of the eddies became kernels of future worlds.

Within the earth-forming eddy, oxygen united with hydrogen to form water vapor. Some of the vapor condensed as droplets or crystals around dust particles, stuck them together, and formed pellets of muddy slush or ice. Lumps of matter swam around and collided, and the smaller merged into the larger. Greater and greater masses were formed; they crashed and combined, until nearly all the solid matter was packed into a planet, which continued the spinning motion of the eddy.

During the hundred million years while the earth's material was gathering, the pressure of sunlight drove gases from the eddy and scattered

n into space. Consequently the iet began without an atmosphere cean. But crumbs of matter fall- into the planet carried some gas ecules "absorbed" around their aces. The hail of particles buried gases. As the planet's material ipacted under the pressure of rity, some of the gas content was eezed out and escaped, but some ibined with other substances to n solids. Water, since it could be ied as ice, was easily captured and risoned.

is it consolidated, the young th began accumulating heat, inly from radioactivity. Accord- to nuclear physicists at the Uni- sity of Chicago, uranium, tho- m, and radioactive potassium ve been decaying on our planet for e billion years These elements merly were more plentiful, and ir heat production was about ten ies greater than it is in modern ies

In one region of the interior after other, solids liquefied Extensive lting seems to explain the present ucture of our planet, whose mate- ls are arranged in an order of in- asing density toward the center. e heaviest substances form a core out as dense as iron This suggests it much of the earth's iron, along th other heavy metals, became elted out of the original material d sank toward the center. The k-forming silicates, being lighter, se toward the surface like slag in a ist furnace.

At a late stage in the building of e earth, its surface was heated by

PARICUTIN, the first volcano to form in the Western Hemisphere since 1759, thrust itself up from a cornfield 180 miles west of Mexico City, Mexico, after an earthquake in 1943. During its first year of activity it built a cone 1,500 feet in height, and spread lava and earth over 10 square miles.

a rain of meteorites These came from rocky bodies that were circling the sun in orbits near the earth's. Gravitation pulled them in As they crashed into the planet the heat of impact exploded them and melted considerable areas Now and then, perhaps, when a giant body punched into the crust, the hole became a well through which molten material poured

Though the planet had no ocean, water was then, as now, a universal ingredient of rock. Granite and basalt, which solidify from molte material, contain water. Whe chunk of granite is heated to mel several substances are driven it as vapors. The most abund

these "volatiles" is water; it may amount to more than 5 percent of the rock.

Between the interlocking crystals of granite lie minute cavities. They hold water, and additional water is bound in the very structure of some of the crystals. It has been there for millions of years, dating from the time when the granite solidified from a magma.

Suppose a body of rock some 20 miles deep in the earth's crust has been heated until it begins to melt and becomes a magma. Minerals with lower melting points liquefy first, and the rock turns plastic, like dough. Then others melt, and it becomes more liquid. Meanwhile, water vapor is released from its ancient prisons and dissolves in the magma.

A magma is like something alive. Its atoms swarm actively around, either singly or in clots. They are in the condition of ions — electrified particles. Ions of the metals—aluminum, iron, and calcium, for example—carry positive charges. Silicate ions, which are formed of silicon and oxygen atoms, have negative charges. The metallic and the silicate ions attract each other, but in their superheated condition they are too lively to unite and form minerals.

When a magma or a portion of it cools, ions begin to link in definite framework — "lattices." Each mineral has its own type of lattice, which causes it to build up a crystal of characteristic shape. The ions cling together tightly in the lattice. That is why rock minerals are hard and rong, and why they stay solid except at high temperatures. It takes a lot of heat to loosen the ions—to melt the crystals. Even when rock is liquefied, ions still pull toward each other, making the stuff viscous, like taffy.

The first crystals that form in a cooling magma float in it like ice particles in slush. Then other substances crystallize, and finally the magma is more solid than liquid.

Meanwhile, the dissolved water vapor goes through a variety of adventures. Water molecules have one side positive and the other negative. This helps them to lock themselves into crystal lattices. But many of the molecules are left out of these arrangements, and crowd the remaining liquid. They shift around like orphans looking for a home, which they do not find. The diminishing liquid cannot hold them, so they effervesce — bubble out of solution. Growing crystals surround the steam bubbles, close in on them, and trap them in cavities.

Some of the earth's imprisoned water escapes when bodies of rock turn liquid. Sometimes a tongue of magma pushes and melts its way upward, either through on old volcano pipe or in new ground. As the tongue rises, volatiles bubble out and escape. Their loss gradually changes the magma into lava. This is a more tranquil stuff, because it retains only remnants of water and other explosive volatiles.

Trouble brews when a plug of hardened lava has stopped up a volcano's neck. Then dissolved water vapor and other gases, straining to

burst out of the magma, build up pressure under the plug. Finally they blast through the top or side of the volcano, carrying with them lava and chunks of the volcano

Submarine volcanoes expel their water directly into the ocean But those on land also add to the sea, for land and air can hold only so much water, and the excess pours into the ocean reservoir.

There are signs that the Pacific has been deepening during the last 30 million years Flat-topped submarine mountains with summits a few thousand feet beneath the surface appear to have been islands that were carried down by sinking of the sea floor. If this is true, the ocean has been growing

What of the future? If the outpouring of steam is to continue unchecked, it would seem only a matter of time before it swells the seas and sends them flooding over the continents A Noah in this deluge would find no landing place.

But happily for us the earth entombs some old water while liberating new As rocks are weathered by air and rain, minerals dissolve into separate ions Rivers carry the ions to the sea There they link with others present in ocean water, forming new crystals Molecules of water enter the lattices and in this way leave the sea

Grains of sand and clay and other materials, including minerals crystallizing from solution, settle, and in time are cemented into rock Some water is trapped in spaces between the grains and crystals and stays there for ages, separated from the ocean reservoir. We can only guess if sedimentation now removes enough water to balance the increment In the past, gains of water exceeded losses Otherwise the ocean would not exist

The ocean itself is a measure of the travail of its creation It testifies that our planet, in earlier days, was more restless than now Heated by radioactivity and exploding meteorites, the earth became largely molten Its volcanoes poured out glowing deluges and blasted clouds of vapor into the atmosphere Steam condensed, cloudbursts pelted down Water poured into great hollows of the surface, while magmas labored and supplied new floods

• • •

Thus the ocean was born, and thus it has been maintained Magmas work in slower tempo now, but still deliver water from the ancient hoard, replenishing the sea and, perhaps, continuing to enlarge it

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WORLD AIR TRAVEL will double in the next ten years That declaration came from Burt C. Monesmith, vice-president of Lockheed Aircraft Corp. By 1965, air travel is expected to jump from 32 billion revenue passenger miles flown in 1954 to approxim 72 billion, a 125-percent gain, according to the calculations Lockheed market research statisticians Estimates for 1955 36 billion revenue passenger miles

How Much Radiation Are You Getting?

The intrepid mariner receives less natural atomic radiation than does his landlubber brother, Dr. W. F. Libby, a member of the Atomic Energy Commission, reports

Doctor Libby has made a statistical analysis of the radiation dosages people receive from natural radioactivity and cosmic rays. His tabulations show that earth dwellers are absorbing natural atomic radiation daily from their neighbors and their surroundings.

People, packed in a crowd, for instance, receive radioactivity from the potassium in their neighbors' bodies at the rate of two milliroentgens per year. However, this does not mean that people are poisonous to other people on account of radiation.

It was found that a seafarer on the open ocean at a latitude of 55 degrees north absorbed 57 mr/yr. By the same token, at sea level on land at 55 degrees north, there was an average of 147 mr/yr and at 20,000 feet, 560 mr/yr.

Wearing a wristwatch 24 hours a da (one with a luminous dial) would giv the central body, including the sex or gans, a dosage of 40 mr/yr.

In outlining other types of exposur that occur in normal living, the AE commissioner listed each X-ray of th lumbar spine, lateral, as giving a dos age of 5,700 mr/yr; uranium ore or the ground, 2,800 mr/yr; in a uraniun mine with all walls of ore, 5,600 and phosphate rock fertilizer on the ground 280 to 700.

The fallout dosage from atomic test on Jan. 1, 1955, Dr. Libby reports, wa about 1 mr/yr, with the total dose dur ing 1954 estimated at about 15 mr "principally because of the Pacific test in the spring"

All these figures fall far below th number of roentgens that must be ab sorbed by the body to bring on sicknes

The stork, long-legged symbol of burgeoning population, is dwindling in its own ranks. Its decline has become so marked in recent years that not a breeding pair of white (or common) storks remains in Switzerland. More than 50 stork families had dwelt for half a century on farmhouse roofs in a Swedish area; but the number fell to one bachelor bird in 1953. Causes of the diminishing flocks are laid to attrition from weather along migration routes, the eating of man-poisoned insects and man's encroachment on feeding grounds, the National Geographic Society says.

Early Romans believed the stork was sacred to Venus, the goddess of love. Thus, when a pair nested on a rooftop the family was blessed.

German folklore held that storks gathered babies from ponds, wells, marshes and springs, where the souls of unborn children dwell, and bundled them to favored families.

Science milestone

Carolus Linnaeus

Name-Giver to Plants and Animals

by Katherine B. Shippen

Condensed from a chapter of the book, Men, Microscopes and Living Things

IN THE 18TH CENTURY the world appeared more and more confusing Besides the enormous variety of living organisms that men found by looking through their microscopes, travelers pushing into distant parts of the earth were bringing back plants and animals that the people of Europe had never seen before

Learned societies, universities, and individual scholars tried to make some orderly arrangement of the vast and increasing store of knowledge They made numberless efforts One man thought he could classify plants according to the color of their blossoms, putting all those with red blooms together and trying to see whether they were in any way alike Another thought it would be better to arrange them according to their leaves — long leaves, round leaves, indented leaves He worked very hard, but did not get on very well. There seemed to be too many plants whose leaves did not fit into any of his categories

While these men were making fruitless efforts to classify plants, there were others who tried to establish some sort of order in the animal kingdom. They talked of the long-haired and the short-haired animals, those with horns and those without horns, and so on.

They studied fish and insects and crustaceans. All these efforts had the same result; and that was failure So far as the men of the 18th century could see, there was no scheme or plan among the living things of the earth

But, in the year 1707, Carl von Linné, later called Carolus Linnaeus, was born at Rashult in Smaland, Sweden.

There was nothing striking about the boy's birth or his background. His father was the village pastor. The family lived in a small wooden house, painted red, with a roof of live turf. It was like many other houses in the village But the house had a garden around it, so that Linnaeus was to say later that it was a good place for a naturalist to be born

All the boy's teachers at school thought him stupid But a doctor with whom his father talked served that Carl took an u terest in plants and that ntify a great many. He

that his father send him to a university, where he could study natural history.

His father could give him only about 40 dollars for his education, but it was thought that he could work his way. So he set off for the University of Lund. After a year at Lund he transferred to the University of Uppsala, since Uppsala had a very fine course in botany. His professor there was the venerable Olof Rudbeck.

Professor Rudbeck soon grew very fond of Linnaeus and saw great promise in his work. In his conversations with his student the elderly professor often spoke enthusiastically of a journey to Lapland he had made in his youth. He told of the reindeer, of the swift mountain streams fed by the melting snows, of the mosses and lichens, the fir trees, the snow fields, the midnight sun. Lapland, which had been a land of romance for the old professor, became a land of romance for the young student too.

After Linnaeus had finished his studies at the university, with Prof. Rudbeck's encouragement he made application to the Royal Society of Sweden to send him on a scientific expedition to Lapland. Linnaeus wrote in the letter of application that he was well qualified to go because, among other things, he had a knowledge of natural history and his legs were so strong that he could walk and climb long distances.

Whether they were impressed by his knowledge, or by the strength of his legs, or by both, the Royal Society agreed to the commission. So, on May 12, 1732, at 11 o'clock in the morning, Linnaeus set out on foot through the gate of the old walled town of Uppsala on the road leading north.

"I carried a small leather bag, half an ell in length but somewhat less in breadth, furnished on one side with hooks and eyes, so that it could be opened and shut at pleasure. This bag contained one shirt, two pairs of false sleeves, two half shirts, an inkstand, a pen case, microscope, and spyglass, a gauze cap to protect me occasionally from the gnats, a comb, my journal, and a parcel of paper stitched together for drying plants, both in folio, my manuscript ornithology, *Flora uplandica* and *Characteris generici*. I wore a hanger [sword] at my side, and carried a small fowling piece, as well as an octagonal stick graduated for the purpose of measuring."

His equipment was in fact not very different from that of a modern naturalist, except that fashions in clothes have changed since that day.

He traveled, mostly on foot, over bad roads and through wild country for nearly a thousand miles. Once a suspicious Laplander shot at him, but missed. Once at night he crossed a rushing stream on a raft and nearly lost his life when the logs of the raft parted.

But he got back to Uppsala in the autumn and gave the Royal Society a careful account of the things he had seen. In his report he noted the customs of the Lapps, whose ways were little-known to the Swedes. He told

1707 CAROLUS LINNAEUS 1778

. . . The founder of modern systematic botany, originator of the binomial (two-name) method of naming plants and animals, and the first naturalist to identify man as *Homo sapiens*.

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According to Linnaeus' system, every plant and every animal was to be given a double Latin name. The first word—whose initial letter was to be capitalized—would indicate to what *genus* or general class it be-longed For example, there were in various countries large numbers of little plants resembling one another, which he called *Primula*, or prim-roses. This genus is almost world-wide. But one kind of primrose he called *Primula vulgaris* Another, with purple flowers, he called *Pri-mula farinosa*, and a third, which we would call a cowslip, he call' *Primula veris* So Linnaeus was to christen hundreds of flowers time naming its genus first, adding the particular

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animals, recognizing easily the difference between the genus of horse or of cat, but indicating in the second part of the name the particular species to which it belonged. Whenever a species was identified, he encouraged the scientist who had first observed it to add his own name.

The naming of plants and animals in this way was a fascinating task. Linnaeus soon announced that everything in nature could be classified, if the scientists but had time and patience Science, as orderly classified knowledge, was coming into its own. *Linnaeus thought that he could even* classify all minerals and all diseases.

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"On his arrival he went first to the Jardin des Plantes, where Bernard de Jussieu was describing in Latin some exotics, as rare plants were called He entered without opportunity to introduce himself There was one plant which the demonstrator had not yet determined and which seemed to puzzle him. The Swede looked on in silence, but, observing the hesitation of the learned professor, cried out, *'Haec planta faciem Americanum habet'*—'It has the appearance of an American plant.'

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He made the teaching of bota[...] *enormously popular Often* he had [...] many as 200 or 300 pupils in [...] classes Students came from G[...] many, Italy, Russia, and other pla[...] to learn from him. Since the teachi[...] was done in Latin, they had no di[...] culty in understanding his words.

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As the years passed, Linnaeus wrote several books on animals and plants, but none was more important than the little *Systema Naturae* that he had worked out on his Lapland journey. Scholars everywhere spoke his name with great respect now. He was Sweden's great man. The Swedish Parliament gave him a title.

At 70 he was still hale and hearty. He suffered sometimes from gout, but he said he knew how to control it by eating wild strawberries.

He died on January 10, 1778, at Uppsala The botanical and zoological gardens fell into decay His widow sold all his papers and writings to a British collector. The King of Sweden, on hearing that they were to be taken out of the country, dispatched a sloop to try to overtake the vessel that carried them, but the vessel got away The papers have been considered ever since a great treasure of the Linnaean Society in London

But though his gardens fell into decay and his writings were taken to London, his students continued the work he had begun From his classroom and from the fields of his botanical excursions they scattered everywhere, collecting, examining, classifying One of them went to the far South Seas, another to Antarctica In Africa, in Asia, in the Western Hemisphere, they were pointing, as Linnaeus had done, to the [illegible] intricacy of the livi[illegible]

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Inventions Patents Processes

Reveal Plans of First Atomic Reactor

The complete plans of the first nuclear reactor, including details which until very recently were top-secret, can be bought from the Commissioner of Patents for 25 cents

The first patent ever issued for the device that made use of atomic energy possible was granted to the late Dr. Enrico Fermi, Nobel Prize-winner, and Dr Leo Szilard of the department of biophysics at the University of Chicago. They were awarded Patent No. 2,708,-656, assigned to the Atomic Energy Commission Drs. Fermi and Szilard originally filed application for a patent on the "neutronic reactor," on Dec. 19, 1944, nearly 9 months before the atomic bomb was dropped on Hiroshima

Containing 27 sheets of drawings and 30 sheets of printed matter, the reactor patent is comparable to a textbook on atomic energy. From it can be constructed a nuclear reactor similar to the first such device built at the University of Chicago, or the X-10 at Oak Ridge, still in use today.

Doctors Fermi and Szilard's patent contains details, heretofore unpublished, concerning several facets of the nuclear reactor. Among these are:

An explanation of "danger coefficients," which are those factors that might be dangerous or inhibiting to the continuation of the chain reaction, necessary for fission.

Explanation of "exponental pile," that is, the geometry of the nuclear pile that must be constructed so that the neutron density declines exponentially with distance from the source. This is necessary, the inventors stated, to increase the neutron ratio above 1, that is, produce more neutrons than are absorbed or wasted.

The method for calculating the size of the pile.

Another method of calculating pile design.

The design for a specific reactor, with a solid moderator.

Another design with a liquid moderator.

Still another design with a beryllium moderator.

Army Gets Jungle Destroyer

R G LeTourneau, Inc has developed a jungle destroyer that packs 3 times the wallop of an M24 tank Each of its 6 wheels is 10 feet tall and 4 feet wide Used for land-clearing operations, the 60-ton vehicle can destroy trees of any size, yet is so light on its feet that it can roll over a pocket watch without damaging it. Its platform is 39 feet long and 11 feet wide, and can support more than 100 tons

—*The Army Combat Forces Journal*

Phones of the Future

A new signaling system for telephone dialing, so fast that it may do away with the dial itself, has been developed by Bell Telephone Laboratories.

To take advantage of the speed of the device, called a polytonic coder, the present dialing system would have to be replaced, perhaps by a push-button

tem. You would punch out your ty's number on buttons on the one's base before removing the rever from the hook. As soon as you k up the receiver, your party's phone l start ringing. If the line is busy, ι need not dial the number over in; all you need do is pick up the one to reach the same party a second ie.

Results of laboratory tests with the naling system were so encouraging, C. A. Lovell, J. H McGuigan and J. Murphy of the Bell Telephone boratories reported, that arrangements were made to try it out on New rk circuits

The tests showed the polytonic signal ıld be used on all except an insignifiat number of the telephone connections in this country —*Science Service*

'ano That Fits in Suitcase

Pianos are getting smaller and small-, but you'll probably never be able tuck one in your pocket.

So says the engineer for Rudolph 'urlitzer Co who has developed the orld's *smallest piano to date, reports* ie *United Press.*

It's a model weighing 80 pounds and fits in a suitcase, says Cliff Andersen, ho heads Wurlitzer's research laboraries in De Kalb, Ill

Spinets, the small upright pianos, eigh around 400 pounds and grand anos weigh well over 1,000 pounds

Andersen says Wurlitzer world's biggest piano maker, is coming out next ear with a model weighing 50 pounds

"This is the limit for the foreseeable uture," says Andersen, "because you've ot to keep standard-size keys"

How do you get the new small size? ındersen says the answer is electronics

Here's the way the new piano works: ι reed is substituted for the strings of a standard piano. When the hammer hits the reed the sound tone is amplified through an electronic circuit, instead of the standard wood sounding board

Sound from the new piano can be turned on and off. When it's turned off, the player listens through earphones.

Since it's also light enough to carry, any apartment-house dweller can have one, says Andersen He added there are currently 19 million piano players in the country and 11 million pianos.

Robot Does Wiring Job

Bell Telephone Laboratories has developed an ambidextrous machine that can automatically wire complex electrical apparatus

The experimental machine, called the "M-4," was developed by the Laboratories to study apparatus and equipment designs best suited for automation. It can neither see nor hear, but it can "feel" and thus follow instructions with great accuracy. Instructions are fed to the machine from a punched tape A series of relays, acting as the machine's "brain," translate this information into electrical signals. The signals then control the cams and gears of the machine

The M-4, designed by R F Mallina, uses a process for making solderless wrapped connections by automatically wrapping 6 turns of solid-conductor wire around a rectangular terminal The high wrapping tension provides an airtight, corrosion-resistant contact between the wire and terminal at numerous points

The experimental machine tating spindles The wire is from a large spool. One the wire to a connecting the same time the wire correct length at the The spindles remove a bı

ment These are cheap enough for such battery use They also have a long enough life But like other radioactive substances they require shielding to prevent radiation danger to people and damage to materials. When nickel 63 becomes cheaper than at present it will become a favorite for use in atomic batteries, because of its long life and tameness of radiation.

Powder Is Rust Remover

A new rust remover available in powder form has been developed for removing corrosion from iron, steel, and also nonferrous metals The powder is mixed with water before use and is said to be nontoxic and nonflammable The cleaned surface is said to retain a corrosion-resistant film which forms a base for any further coating or plating

The powder, produced by the By-Buk Co Los Angeles, Calif, removes rust and corrosion in 10 minutes to 3 hours, depending on the amount When used as a hot bath, the action may be completed in 2 seconds to 10 minutes, according to the company The preventive film will protect metal for several weeks or months, depending on the atmospheric conditions

—*Materials & Methods*

Tubeless Tires for Trucks

New one-piece rims and tubeless tires, both developed by The Firestone Tire & Rubber Co, will be standard equipment on 1956-model trucks and will permit the nation's truckers to carry more payload more safely than ever before, Raymond C Firestone, executive vice-president of the Firestone Co. announced recently.

With the new assemblies, truckers will gain the advantages of tubeless tire construction which were introduced to buyers of new automobiles this year These advantages include greater puncture and blowout protection in a tire that runs cooler and, therefore, has longer life than a tire with a tube

In addition, tubeless truck tires and 1-piece, drop-center rims are considerably lighter than multi-piece rims and tubed tires that long have been standard in the trucking industry. The weight reduction means each truck can add extra payload per mile.

Pots and Pans That Won't Need Scouring

Scrubbing and scouring pots and pans may be a thing of the past. A technique has been developed that makes cooking utensils "food-sticking proof," Frank E. Hammond, president of the Selinized Process Co, Omaha, Nebr, announced

The process, called "Selinization" prevents food from sticking to metal. Foods can be fried baked, boiled or broiled without fats or cooking oils and will still come out of the container without adhering to the treated metal

Discoloring or corroding of pots and pans is also eliminated, Mr. Hammond reported "Selinization" is named after a father-and-son research team S A Seline and S A. Seline, Jr, who are responsible for the metals treatment development.

Utensils treated with the stick-proof process will be available by 1956

THE most powerful atom smasher in the world the Univ... California's bevatron, is transforming energy into matter highest man-made energies ever produced: 4 billion electr...

WORLD HAS 2,000 LANGUAGES

About 2,000 completely distinct languages are spoken in the world and nearly half this number are native to North and South America, estimates Dr. J. Alden Mason, curator of the University of Pennsylvania Museum. There are, or were, more separate languages in California than in all Europe.

Relatively few have ever been put in writing.

There are no primitive languages, declares Dr. Mason, who is a specialist on American languages. The idea that "savages" speak in a series of grunts, and are unable to express many "civilized" concepts, is very wrong, he says.

"Of course, the savage has no single word for *atom* or *isostasy*," Dr. Mason explains, "but if he had to explain the concepts in his language he would have no difficulty in doing so."

"In fact," he says, "many of the languages of non-literate peoples are far more complex than modern European ones."

"English is one of the simplest languages in the world," Dr. Mason says. Only Chinese is simpler.

Evolution in language, Dr. Mason has found, is just the opposite of biological evolution. Languages have evolved from the complex to the simple. In the case of Latin, for instance, its modern descendants, Italian, Spanish, Portuguese, French, are grammatically simpler than the parent

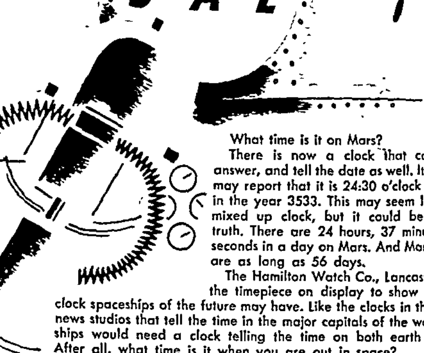
"Of course there must have been a time," he admits, "when grammars were building up, but that time was early in human history, maybe hundreds of thousands of years ago, of that period we know nothing."

Today, primitive peoples may roughly represent the speech of Stone Age Man. Typically, their grammars are much more complex: they often have more genders, numbers, persons, tenses and modes, especially the latter, than any modern language.

Many American Indian languages are on the verge of extinction, spoken by only a dozen persons.

Little by little, the University Museum is building up a collection of recordings of the speech and songs in these little-known languages before they disappear completely. The project is described by Dr. Mason in the University Museum *Bulletin*.

SPACE



What time is it on Mars?

There is now a clock that can give the answer, and tell the date as well. Its many dials may report that it is 24:30 o'clock on Sept. 52 in the year 3533. This may seem like a crazy, mixed up clock, but it could be telling the truth. There are 24 hours, 37 minutes and 12 seconds in a day on Mars. And Martian months are as long as 56 days.

The Hamilton Watch Co., Lancaster, Pa., put the timepiece on display to show the kind of clock spaceships of the future may have. Like the clocks in the television news studios that tell the time in the major capitals of the world, spaceships would need a clock telling the time on both earth and Mars. After all, what time is it when you are out in space?

Doctor I. M. Levitt, director of Fels Planetarium of the Franklin Institute of Philadelphia, conceived the "space clock" and made the astronomical calculations for it. Mechanical design was done by R. B. Mentzer, assistant director of research for the Hamilton Watch Co.

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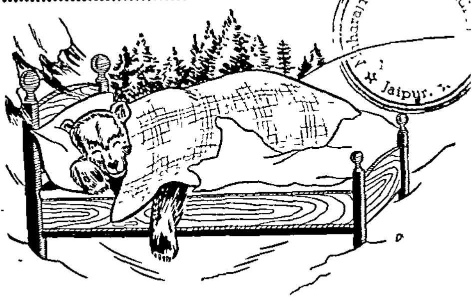

THE BIG SLEEP FOR ANIMALS

by Will Barker

Condensed from Natural History

THIS IS THE TIME of the big sleep for the bees, the bears, and even the buds of those plants that shed their leaves And the intensity of this winter sleep, or hibernation, depends on who's doing it

The sleep of the bears, for instance, would probably be considered a severe case of insomnia by the woodchuck. The woodchuck often puts in a solid six months of sleep—almost double the time the black bear spends in drowsing the winter days away

In the North, the woodchuck goes below decks earlier than his kinfolk in the Deep South In the Province of Quebec it may be the middle of September The woodchuck settles down either in a grass bed at the end of his tunnel or in an unlined side chamber

He has an effective way of saying DO NOT DISTURB to the opossums, skunks, or rattlesnakes that would like to share his snug winter quarters He buries himself alive by sealing off his sleeping chambers with dirt scraped from the far end of the room

Once privacy has been insured, odchuck rolls up in a ball, his h

traces of slime were noted on the card. It was immediately put in water, and when the shell came off the card the animal crawled out.

The estivating and hibernating habits of plants are more like those of cold-blooded animals than those of bears and the like. Plants are affected by temperatures too low for the normal life processes and also by loss of water through skin surfaces. Winter is a period when running or unfrozen water is hard to come by. Perennial plants are adapted to such seasonal changes by the leaf-shedding habit and by the sealing of dormant tissues. This same mechanism is used by plants in hot dry periods in the tropics.

We do not usually think of hibernation in connection with birds. But there are three reports to indicate that the poorwill is trying to get into the act. This character of our Western states has suspended its animation to a point where the heartbeat could not be detected and no moisture could be noted on a cold mirror placed in front of the nostrils. Strong light beamed at the pupils of its eyes brought no response, not even an attempt to close the eyelids.

So, by all conventional standards, the poorwill can participate in the deep sleep of winter. Instead of doing what any right-thinking bird would do, it seems inclined to escape the tiresome trip south on crowded flyways. And it must have been ignoring the traditional migratory pattern of other birds for a long time, because the Hopi Indians call the poorwill "Holchko," the Sleeping One.

• • •

Right now, the big sleep is on for countless kinds of animals. In the hidden places where naturalists rarely see them, they are sleeping away the cold months with pulse and breathing near the vanishing point, while man, who has lost the knack of complete repose, lengthens his days artificially so that he can continue his frenetic activity, either at home or abroad.

Tiny Tube for UHF Television

A tiny new ceramic vacuum tube developed by General Electric promises to bring UHF television within the range of thousands of heretofore "televisionless" homes

J. E. Nelson, G. E.'s tube department Chicago regional manager, said the tube will amplify UHF television signals more effectively than any existing receiving tube, but he pointed out that TV set manufacturers must develop new tuners and converters before the fullest advantage of the new tube can be realized

The tube is about the size of a bracelet charm and its shape somewhat resembles a tiny beer keg It is made of [illegible] rings sealed

How Much SPEED Can We Stand?

by Waldemar Kaempffert

Condensed from The New York Times

COLONEL Horace A. Hanes, an Air Force test pilot, recently beat the world's jet-speed record by going through the sound barrier in straight and level flight at 822.135 miles an hour.

The speed of sound at sea level is 763 miles an hour at 59 degrees Fahrenheit. It varies with temperature and altitude — at 30,000 feet where the temperature is 67 degrees below zero, it is 660 miles an hour.

The colonel's speed was 1.23 times that of sound on a course 11 25 miles long at 40,000 feet over the Muroc Desert in California

Colonel Hanes' performance, notable because it was timed in accordance with the rules of the Federation Aeronautique Internationale, whose reports of speed records are official, has been surpassed unofficially more than once.

It was surpassed by Maj. Charles Yeager in the experimental Bell X-1A rocket-driven research plane launched from a B-29.

It was also surpassed on the ground by Lieut. Col John Paul Stapp, Air Force surgeon, who took a "sleigh ride" in which he reached 995 miles an hour after rockets had kicked him along a track for a few seconds

Performances of this kind are not recognized by the Federation Aeronautique Internationale The Air Force cares little if they are or not Neither does Col Hanes. Military planes have been increasing in speed until they are now able to travel at sonic speed. A few experimental models have entered the supersonic region The optimists believe that some day 2,000 miles an hour may be reached.

What, then, is the point of the high-speed tests of the Air Force? Tacticians want to know how much speed the human frame can stand Army medicos discuss the subject in terms of gravity. At rest we are all subject to what is called an "acceleration of g," the "g" being gravity Deceleration, with the attendant shock of stopping suddenly, is also measured in g's Men have [illegible] from high bridges into rivers so they hit the surface with a

tion of more than 8 g's and have been none the worse for the experience. It was long supposed that 9 or 10 g's were about all that a man could stand. That supposition has been exploded by daring men like Col. Hanes and Col. Stapp.

There is evidence that the human *body can stand any speed in straight-*away flight. It is when turns are made at high speed that deficiencies appear. On a steep bank the flier's body is at right angles to the vertical. Centrifugal force drives blood toward his feet. The brain needs oxygen, and the blood alone can supply it. Hence the blackouts that occur on sharp turns at high speed.

But though high speed in straight-away flight has no physiological effect, the brain cannot make muscles behave as they should. Muscles may be perfect, but it takes a little time for the brain to tell them what to do. Even at 300 miles an hour a plane travels 440 feet a second It covers 10 yards in the time taken by the brain to communicate with the hand.

Though there are no centrifugal forces to contend with in straight flight, precautions have to be taken against sudden accelerations and decelerations.

Stapp on his famous run slowed down to 632 miles an hour and came to a stop in 1.4 seconds with the aid of scoops that knocked down obstructions and plowed through water. This meant that he was subjected to 40 g's: far more than it was once supposed any man could stand A terrific jolt brought the short test *to an end. It was worse than* if Stapp had jumped from the Brooklyn *Bridge.*

The safety belt that holds the passenger in his seat on a commercial airplane is not good enough to withstand stops as sudden as those to which Stapp subjected himself The usual safety belt, but somewhat broader, is supplemented by straps that pass over the shoulders. Another strap pins the arms to the body Legs are tied together. A tight strap across the chest holds the spine against the back of the seat. About all that a man in Stapp's situation can do is to move his hands within limits; for even his wrists are tied to his knees, a little slack being allowed.

If Stapp had not been thus harnessed into place he would have gone through the windshield like a shot and bounced a thousand feet down the track when the sled was suddenly stopped. But he proved that, when a flier is properly belted and strapped, his neck will not snap forward and break, consciousness will not be lost, internal organs will not be torn loose, joints will not be dislocated and lungs will not collapse.

NEW AUTOMOBILES this year are better lighted than ever before The average 1955-model passenger car uses 22 8 light bulbs. This compares with 20 just two years ago. The typical American home employs only about 19 general lighting lamps.

We can define astrology by saying that it is the . . .

SUPERSTITION OF THE STARS

by Patrick Moore, F.R.A.S.

Condensed from a chapter of the book, The Story of Man and the Stars

IN OR ABOUT the year A D 570, when the splendor of Rome had faded and the glory of Greece was no more than a dim memory, a remarkable man named Isidorus was born in Carthage. He was not, of course, a member of the great Phoenician race which had come within an ace of destroying Rome itself; Ancient Carthage had been razed to the ground centuries before, and a plow driven over its site. Yet Isidorus can perhaps be regarded as the last important Carthaginian. He became Bishop of Seville, and as well as taking a leading part in Church affairs wrote wisely upon all sorts of subjects, including theology, history and astronomy.

Isidorus' importance does not, however, rest upon his own researches; he was content to summarize the results of others, and contributed no new material himself. His chief merit was that he drew a really clear distinction between the true science of astronomy and the false "science" of astrology.

We can define astrology by saying that it is the superstition of the stars. Nowadays the word conjures up the picture of a column in one of the Sunday papers, headed "What the Heavens Foretell," and studded with various odd designs that look like some wild jig-saw puzzle. Yet astrology goes back far into the past. →

tion of more than 8 g's and have been none the worse for the experience. It was long supposed that 9 or 10 g's were about all that a man could stand. That supposition has been exploded by daring men like Col. Hanes and Col. Stapp.

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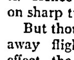

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The Story of Man and the Stars copyright 1954 by Patrick A Moore and published at $3 95 by W W Norton & Co Inc , 101 Fifth Ave , New York 3, N Y

We can understand how it began. Even if the stars and planets were not gods themselves, surely they must have been created by gods—and, as such, be capable of controlling the destinies of men? The earlier cults, such as that of Egypt, were purely astrological in character.

The old philosophers, even the enlightened Greeks, were astrologers first and astronomers afterwards—if, indeed, they realized that there was any distinction between the two. As knowledge increased, the crack started by Isidorus grew steadily into a vast gulf, until by the end of the Middle Ages astrology was grouped with alchemy and occultism rather than with true science. Before condemning astrology out of hand, however, let us see if it has any scientific basis at all.

In astrological lore, the most important bodies are the sun, the moon and the planets. Each has its own influence; Saturn, for instance, is generally baleful, while Jupiter is benign. Moreover, each planet controls a particular part of the body. The Egyptians allotted Saturn the left eye, Mercury the tongue, Mars the right nostril, and so on. However, the power and effect of a planet varies according to its position in the sky.

Most people have heard of "horoscopes," but not everyone is sure exactly what a horoscope is. Basically, it is a chart of planetary positions. To cast a horoscope, an astrologer would work out the exact positions of the planets at the time of the subject's birth, plot them on a complicated chart, and then draw conclusions as to the character, career, temperament and fate of the person concerned.

A few hours' difference in the ti of birth means, of course, that t astrological pattern will work quite differently.

Let us look more carefully into t principles upon which astrology based. The most vitally importa pieces of information for horoscop casting concern the apparent po tions of the planets, since Saturn the constellation Leo would natural have a different effect from th which it would exert if in Virgo, a so on. But what is meant by a plan being "in" any particular constel tion? The planets are millions times closer than ordinary stars, that all we are discussing is a me effect of perspective.

At the time of writing (Ma 1955), Saturn is seen against th background of stars in the constell tion Libra, the Scales Yet Saturn certainly not "in" Libra. Libra itse is a man-made pattern constructi simply because some ancient sta gazer fancied that a few insignifica stars in the southern sky could b made to outline the shape of a pa of scales.

An analogy can be drawn from near-by post seen against the bac ground of a distant clump of tree It is not correct to say that the po

PATRICK MOORE is secretary of the Lunar Section, British Astronomical Association, and a fellow and council member of the British Interplanetary Society

is "in" the trees; it is nothing of the kind.

We can carry this analogy a step further. The Greeks believed that the fixed stars were nailed to the celestial vault, and were thus all at the same distance from us. The distances of the stars are, in fact, far from identical—Rigel, for instance, is 70 times as far away as Sirius. The stars in Libra have no possible connection with each other, except that they happen to lie in roughly the same line of sight as seen from the earth Our clump of trees can be replaced by isolated trees here and there, strung out in a long line stretching almost to the horizon

• There is a great deal of unmapped country within us. —George Eliot

Consequently, instead of saying that a planet is "in" a constellation, it would be more accurate—though less convenient — to say that it is "seen against a background of nonrelated stars that have been artificially grouped into a constellation" There is no physical significance or connection whatever.

We know that the sun is the center of the solar system, and that the nine planets go round it Moreover, the planetary orbits are in pretty well the same plane. The orbit of Mercury is tilted at an angle of 7 degrees to ours, and those of the remaining planets have inclinations of less than 4 degrees (apart from Pluto, which is a peculiar body and should probably not be classed as a major planet at all) We are thus not far wrong when we draw a plan of the solar system upon a flat piece of paper. A little thought will show that this means that the planets must keep to a certain belt in the sky. This belt stretches right round the heavens, and is known as the zodiac.

A few technical terms must be introduced here. The central line of the zodiacal zone is marked by the apparent path of the sun among the stars, and is known as the ecliptic; the celestial equator is the projection of the earth's equator upon the celestial sphere, and the two points at which the ecliptic and the celestial equator intersect are known as the equinoxes.

In a year, the sun makes one apparent trip round the zodiac, so that it crosses the celestial equator twice — once when going from south to north (spring equinox, in March), and once when going from north to south (autumnal equinox, in September). At the equinoxes, days and nights on the earth are of equal length When the sun is in the northern sky, the days in the northern hemisphere are of course longer than the nights.

The old shepherd-astronomers divided the zodiacal belt into 12 constellations Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion), Virgo (the Virgin), Libra (the Scales), Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Sea-goat), Aquarius (the Water-bearer) and Pisces (the Fishes)

Horoscopes depend upon the tions of the sun, moon, and p

"in" these constellations, with the position of the sun at one's birth giving the key to the person's whole character. A man born "in the sign of Leo" is said to be utterly different from a man born in the sign of Virgo or Libra.

When the astrological cult began, the spring equinox—that is to say, the point at which the sun crosses the celestial equator in its journey from south to north—lay in the constellation of Aries, which was therefore taken as the first zodiacal sign. Unfortunately, although the ecliptic—the central line of the zodiacal zone—remains more or less constant, the celestial equator does not.

Every modern schoolboy knows that the earth is a globe rotating upon its axis once a day, and that the axis points northwards to the celestial pole. But the polar point moves, describing a circle in the sky in a period of about 26,000 years. At the present time the axis points roughly to the bright star Polaris, whereas in the time of Cheops and the Great Pyramid the axis pointed to a much fainter star, Thuban. A shift in the pole produces a corresponding shift in the position of the equator—and hence in the equinox.

Today, the spring equinox is no longer in Aries. It has shifted backwards into the neighboring constellation of Pisces, so that the zodiacal signs are out of step with the constellations themselves. This does not, apparently, affect their astrological significance.

How this extraordinary claptrap can have lasted for so long is a matter for wonder. As a matter of fact, it did decline for many years following the discovery of the true nature of the universe, but recently two world wars have helped to revive it and today the number of practicing astrologers in London and New York alone is depressingly great. Human credulity knows no bounds.

Actually, the cult is fairly harmless on the whole. Like the hollow-sphere enthusiasts and the members of the Flat Earth Society, astrologers are entitled to their opinions. But if we try to find any science in their creed, we run up against a blank wall.

What connection can there be between the apparent position of a planet, seen against a background of non-related stars arbitrarily arranged in a pattern like so many croquet balls spread across a lawn, and the character and destiny of a human being? The average astrologer will not argue; he will merely quote what he calls the Ancient Teachings (the capital letters are his), and retire to his charts and horoscopes.

The only danger is that he may delude some over-credulous person into making unwise decisions. There have been too many cases of people investing their money according to astrological advice, only to find themselves homeless and destitute in the end.

Now and then we come across predictions which have actually been fulfilled. One lovely story is told by the Rev. John Flamsteed, the first British astronomer royal, who took office in the year 1675. Like all stargazers, he was persistently bothered

by those who did not know the difference between astronomy and astrology, but nevertheless wanted to learn the wisdom of the stars

On one occasion, he was visited by an old woman who wanted his help in finding a mislaid bundle of laundry. Flamsteed decided to give her a lesson He therefore cast a horoscope, drew a plan of her house and garden, and selected a position quite at random — meaning to send her on a fruitless errand, and so drive home the futility of trying to invoke Olympian help to settle human problems The laundry turned up in the precise position indicated.

Much more recently, a friend of mine who is an eminent astronomer, cast a horoscope for pure amusement, and found that he had made remarkably correct predictions!

Doubtless our typical astrologer would attribute these coincidences to the validity of the Ancient Teachings But happy accidents are not confined to astrologers. Half a century ago, there was a spate of almanacs which professed to forecast the exact weather for every day of the coming year One of these reached the proof stage with the month of June accidentally omitted, and the editor instructed a junior assistant to fill in anything that came into his head The boy took him at his word, and forecast rain, hail and snow for Midsummer Day. All three duly turned up

However, all this is by the way. Astrology was natural enough in past ages, but in the light of modern science it is utterly baseless—founded only on superstition, human credulity and a good deal of fraud. It will probably linger on for many years to come; old traditions die hard. But it is true to say that an astrologer with genuine mystical powers is about as common as a great auk

Predicts Space Travel in Next Half Century

Less than half a century separates man from travel in outer space, it was predicted by an expert who has sent animals through the cosmic ray barrier.

Space travel will be relatively safe, Otto G Winzen added The big problem is to leave and re-enter the earth's atmosphere

Winzen heads a research firm at Minneapolis, Minn, which is trying to solve that problem for the United States' armed services He is sending balloons carrying live animals, in a sealed, air-conditioned gondola into the crucial areas where cosmic rays break up and explode

"Maybe in 20 or 30 years we will have the answer," the 37-year-old, German-born scientist said "I foresee space travel by the end of the century."

Winzen believes the danger-
around 118,000 feet, where co
strike the earth's atmospher
and explode

Say Earth Is 5 Billion Years Old

A guessing game that has kept scientists busy for centuries appears to have ended. According to Dr. J. Laurence Kulp and Dr. George L. Bate of Columbia University's Lamont Geological Observatory, this planet is some 4,800,000,000 (almost 5 billion) years old.

Their recent determination by the isotopic-composition-of-lead method is much higher than early estimates of 2 to 3 billion years and lower than more recent estimates of 5 to 6 billion.

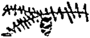
• • •

The two geochemists compared the isotopic make-up of modern lead with that of meteorite lead (which is assumed to be as old as creation). Lea [illegible]

three are in part the end-products of decaying uranium and thorium.

Using chemical analysis and arithmetic, Drs. Kulp and Bate determined how much of the modern lead had originally been uranium and thorium at the moment of the earth's formation. Then, since the decay rates or half-lifes of uranium and thorium are accurately known, they translated this into a time-span of 4,800,000,000 years — give or take 200 million.

Christmas Trees Are Older than Christmas



This is the season when some 30 million little trees are brought into 30 million unseasonably warm front parlors and loaded down with enough tinsel, twinkling balls and colored lights to build a glittering highway from the earth to the moon.

Christmas trees, like many other things which decorate homes at Yuletide, are older than Christmas itself. They were first used in lands far from Bethlehem. They belong to the North, to dark and savage lands beyond the Rhine and the Danube.

The favorite Christmas tree in America is the spruce. There are several types of spruce, but they all can be spotted by their short, sharp, prickly needles, each one standing on a miniature pedestal by itself. Their small cones hang downward.

Then there is the fir, close cousin of the spruce. Firs have softer needles, usually curved, and their cones stand straight up.

Pine trees, often used at Christmas, can be told from spruce or fir by the fact that their needles come in bunches or pairs instead of singly. White pines always have five needles in a bunch. The various yellow pines have less than five—usually two.—*Science Service*

You Must READ To Get Ahead

by Lyle M. Spencer

Condensed from This Week Magazine

YOU MAY NOT SEE any headlines about it, but the biggest news in business today is the great switch-over from brawn jobs to brain jobs—the fast-growing White Collar Boom. The labor market is shifting from blue-shirt employees with strong backs to skilled craftsmen and mental workers.

Whether you are a young man looking for your first job or a seasoned wage-earner, it is time to take a look into the years ahead and see how you fit into this very real "revolution."

First off, what's at the root of the White Collar Boom? Very simply, it's Automation, that wondrous new word that is cropping up more and more often in newspapers and magazines. Electronic machines will gradually take over the monotonous assembly-line chores that semi-skilled and unskilled workers are performing.

A whole new field of thinking, know-how jobs will be created—the great need will be for men who can manage the machines, or do work , complicated for the machir bur F Murra, of the Nati cation Association, rece

This Week Magazine (Aug. 14, '55), 421 Lexington Ave., New York 17, N. Y.

a convention of that society that "educated manpower" equipped for the era of automation is in critically short supply.

What this means to you, the wage-earner, is very plain: in the coming years, education and training will be more vital than ever before. In simplest terms, it is the *reading* man who will reap the profit of this new era

The ability to read is the most important mental skill we ever learn. When you were in school, *about 90 percent of everything you learned came through reading*, and the pattern is not much different in the job world. Teachers say that the commonest cause of failure in school is lack of ability to read rapidly and intelligently.

Out in the job world, alert businessmen are becoming conscious of reading skill. One personnel manager put it this way:

"Automation is taking hold rapidly in factories and mills, and we're beginning to see electronic computing machines in many offices These cost-saving machines make possible steadily rising wages for all of us.

"Biggest bottlenecks now are the minds of men who haven't increased their ability to read and absorb the new information that's essential to handling complicated jobs."

Make no mistake that only the blue-shirters need to wake up to the new emphasis on reading. It's also important to workers who already have white-collar jobs. A company president who had just installed a reading-improvement course for his administrative personnel has something to say about executives as well

"The best executives, I'm convinced, are the ones who are able to maintain a broad outlook and perspective on our business That's why I insist that our top management people continue to read widely in areas outside their own fields."

But in the face of this growing new challenge, the bitter truth is that most adults read with appalling inefficiency. Most of us stopped learning the skill of reading somewhere between third and sixth grades, just when we were really beginning to get the hang of it. And far too many of us lost the habit of serious reading to improve our minds soon after we slammed our schoolbooks shut for the last time.

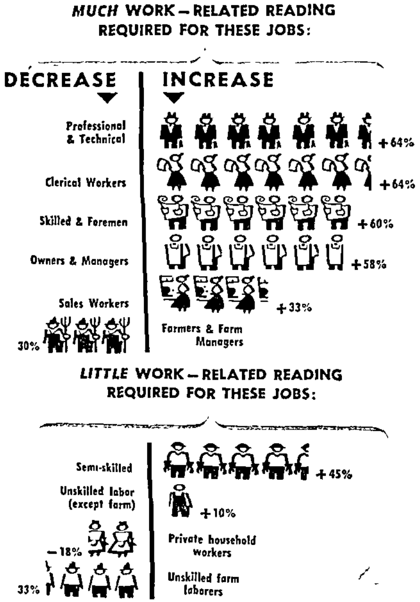
Thus, when he does read, the average adult stumbles along at a rate of between 200 and 250 words a minute on an easy-to-read article like this one, with his mind absorbing only 50 to 60 percent of the ideas the text contains With a little training, an adult with ordinary intelligence can learn to read material of medium difficulty at from 450 to 600 words per minute and understand 80 to 90 percent of it.

(A simple way to check your own reading rate is this: select any non-technical book or magazine and ask someone to check you with a watch Read normally for one minute flat Then count the words you have read

If the result is 200 or less, your reading rate is poor; 200 to 300 is fair; 300 to 720 is good; over 720 is excellent.)

Many of us have lazily decided

Employment rose 31 percent from 1940 to 1954. Here are U. S. Department of Labor figures showing how "reading required" jobs hold a lead over "non-reading" jobs.



GRAPHICS

that because we can keep up superficially with what's going on through radio, TV and movies, it no longer makes much difference whether we *can* read well and *do* read widely. Nothing could be farther from the truth.

Take a look at the chart on page 17, summarizing the mental-skill revolution now occurring in our country. As you see, the job areas growing fastest are largely the ones requiring a considerable formal education. These are also the fields where technological and scientific changes are occurring so rapidly that successful job-holders must keep pace through regular reading and study.

Needless to say, the white-collar jobs in these growing fields pay a good deal more than those requiring little or no training.

Let's take an extreme example. The professional and technical workers, represented by the top bar of the chart, have completed about 16 years of schooling—that is, 4 years of college. Their yearly incomes averaged around $5,100 in 1954 and those with post-graduate work earned a good deal more. Physicians and surgeons, for example, made an estimated average of $11,000 in 1954

At the other extreme were unskilled farm laborers who had finished only 7½ years of schooling. Their income, including the dollar-value of food and shelter furnished, was only about $1,500 in 1954, the lowest of any occupational group in our country.

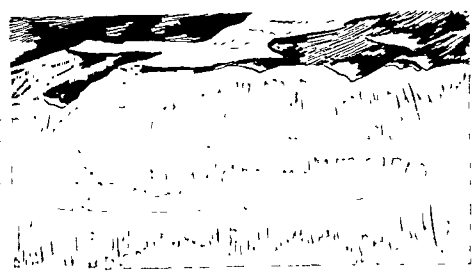
This growth in good job opportunities is by no means limited to people who have been to college. Many of the most exciting fields are open to men and women with only a high-school education who obtain some additional specialized training Right now, for example, there is a nation-wide shortage of 35,000 aircraft mechanics and 25,000 electronic-equipment operators. Both fields are changing with lightning rapidity, and almost constant retraining and study are needed to keep abreast of new developments

Many of the most interesting growth fields range up from the skilled clerical and craftsmanship jobs to what are called the "semi-professions," key assistants to top engineers, the laboratory technicians to biologists developing new vaccines and operators of delicate equipment for nuclear physicists and chemists

The numbers of these jobs have more than doubled in the last 15 years and are still growing fast. They require about two years of college, an interest in technology and machines and a desire to continue mental self-improvement through regular reading.

Just how do you go about improving your reading skill? There's no trick to it—readers are made and not born. If a high school or college offers a reading course, enroll in it.

Using modern teaching methods, most adults can improve their reading speed by 50 to 100 percent with 20 hours of such training If such a course is not available, inquire at your library for books on reading improvement.



Riddles of the Northern Lights

by Harry Pease

Condensed from The Milwaukee Journal

THE SCIENTIFIC WORLD has set itself to learn what lies behind the misty draperies of the northern lights.

Two thousand years ago it was enough for sages to explain the shimmering clouds as "horsemen running in the air, in cloth of gold, and armed with lances like a band of soldiers." But now that flight into the thin and eerie realm of the lights is seriously contemplated, something more specific becomes essential

The twelvemonth which begins with November, 1957, has been designated the International Polar Year Scholars from all nations will make a concerted attack on the mysteries of the high latitudes, including the aurora.

The aurora borealis (northern lights) concentrates in a ring that centers on the earth's north geomagnetic pole, near Etah, Greenland. The aurora australis (southern lights) forms a similar pattern at the opposite extremity of the earth. Theory demands that they differ from one another, practice inquires, "How?" and "Why?"

Why should the aurora be different in daylight than at night? In what way is it associated with e trical and magnetic storms sometimes disrupt communi What is the air like up ther gases are present? Are th

The Milwaukee Journal, Milwaukee 1, Wis

electrically charged? How hot are they? Is there dangerous radioactivity?

In an effort to get the answers, a great network of observing stations in the far north and far south will be equipped with automatic cameras which will photograph the entire sky each five minutes.

Some stations will be equipped with spectrographs to determine the wavelength of the light and learn the nature of the atoms emitting it.

Stations in high latitudes in both hemispheres have been paired to watch for displays that occur simultaneously at both extremes of the earth. Fairbanks, Alaska, will team with Marquerie Island in the Antarctic; an observation post in northern Siberia with one on Heard Island, also far in the southern ocean.

Radio observers will experiment with the "bounce" of signals from the upper layers of charged air. They will "listen" to distant stars which transmit radio signals and see what change an aurora makes. They also will watch for signals which come from the aurora itself.

Rockets will be fired into the upper air from Fort Churchill, Ont., on Hudson Bay.

Doctor Sidney Chapman of Cambridge University, England is recruiting a world network of volunteers to simply watch and report on the aurora.

We are inclined to think of the northern lights as an intermittent occurrence. They are visible 12 days a year, on the average, in the northern parts of the U. S. But over Hudson Bay they are almost contin[uous]. Statistics show 243 displays a y[ear] and the other days are accounte[d for] in terms of cloud and storm w[hich] hide the aurora.

In the Arctic the lights a[re a] breathtaking spectacle wholly u[nlike] the pale chartreuse veils we [see] draped across our skies. Dr. Jo[hn] P. Moody, a Canadian governm[ent] physician stationed in the Hu[dson] Bay area, described an aurora t[hus]:

"Suddenly, long temporary arc[s of] light stretched over various len[gths] of the lines from the celestial po[le to] the horizon. These vertical foc[i of] light yellow multiplied into mill[ions] of fluttering, dancing arcs w[hich] fluoresced all the colors of the r[ain]bow. Reds, yellows and greens w[ere] especially prominent, but all [the] spectral colors were faintly visi[ble].

"All at once, as if a celestial b[...] was released, the wavering li[ghts] leaped to the other sky segments, [and] the fabulous spectacle of north[ern] lights stretching and vibrating fr[om] the horizon to the sky's peak co[uld] be seen in all directions.

"When this took place the brig[ht]ness was unbelievable, and the [re]flections on the ice and water cau[sed] both to glow with a strange, smold[er]ing fire of golden, greenish hue.

"Then, abruptly, the lights rece[d]ed until a single, lonely pillar w[as] left dancing and vibrating in the v[el]vet sky. . . ."

This daily occurrence of auro[ras] in the north leads scientists to su[s]pect that the earth does not revol[ve] in empty space, but rather swi[ms] endlessly through the turbu[lent]

outer reaches of the sun's atmosphere.

It has long been recognized that there is some relationship between sunspots, magnetic storms and the aurora. It remained for Dr. Aden B. Meinel of Yerkes Observatory, Williams Bay, Wis, to show in 1950 that the aurora borealis is associated with a shower of protons—hydrogen atoms stripped of their electrons—continually spewed out by the sun.

The storms, stresses and tumult in the sun are inconceivable to men on the placid earth The multimillion-degree solar heat wrenches as many as 15 electrons from some of its heavy atoms, and stirs tremendous electrical and magnetic cataclysms. Apparently the trouble begins far below the surface of the sun Astronomers first see it as bright spots which hurl mighty streamers of fiery gas farther out than the distance from earth to moon Then these collapse and leave yawning vortices big enough for half a dozen earths—the dark blotches we see as sunspots

The spots always appear in pairs, at about the 30th degrees of solar latitude, north and south. One is positively, the other negatively charged And their polarity alternates in 23-year cycles, for 11½ years all the northern-hemisphere spots are positive and the southern ones negative, then the opposite occurs

In the uproar, particles are hurled out. For reasons not yet understood, their effects may be felt on earth 17, 26, 31 or 36 hours after the outbursts occur Light takes only about eight minutes to cover the same distance.

> • In science . . . no advance is final Every question solved produces new riddles to answer, since every higher step *gives us a wider outlook and* the power of seeing problems which from a lower level were not apparent
>
> —Ernest Starling

On earth, radio and even telegraph and telephone communications may be ruined during these magnetic storms. Compasses may swing several degrees And the aurora glows

The light we see does not come from the sun It appears to be generated as light is generated in a neon tube by an electric current The hurtling atomic particles from the sun dislodge electrons from the atmospheric atoms The electrons store energy for a little while. Then the energy is released again as multi-colored lights

Theoretically, the particles that cause the aurora australis should be different from those that cause the aurora borealis

The earth acts as though it were a bar magnet about 400 miles long surrounded by a lump of inert matter Its field diverts the onrushing charged particles, forcing them from the equator toward the poles From the moon, the earth would appear to wear two halos of aurora

But since the earth magnet has two different poles, it should turn positively-charged solar particles one way and negatively-charged (other.

What excites the so brilliance could be the i torn from the hyd.

light the night-time northern skies.

In a few cases an aurora has been seen in the daylight sky. For some still unknown reason, the daylight auroras are as much as twice the 250-mile-peak height of the night displays.

Night auroras may center as low as 150 miles. Several rockets have flown almost this high, and at least one has reached 250 miles. But the rocket observations are brief and expensive, while the spectrograph can learn much from the aurora's light.

The hazy green is characteristic of oxygen. So is one of the reds. Blue and violet may come from nitrogen. A hydrogen red has been seen. Photographs indicate, too, that there is considerable invisible ultraviolet in the northern lights.

So far, scientists do not blame the aurora for magnetic storms. Rather, they say, the two are caused by similar events. Often they will coincide, but not all displays of the northern lights are accompanied by magnetic storms and not all storms bring the northern lights.

People in this latitude are accustomed to thinking of the aurora as a winter event. Scientists think otherwise. Part of the reason for the common belief may be that the displays are associated with the cold regions, part of it may stem from the fact that the winter nights are longer and afford more chance for seeing a celestial show.

Actually, the powerful bombardments necessary to make the lights flicker here are most apt to strike the earth in spring and fall, when the earth is closest to the sun.

Leaf Analysis Foretells Orange Crop

Use of a single research tool, chemical analysis of leaves, can be credited with an essential role in the boosting of citrus production from 150 to 350 boxes per acre in Florida groves, reports the U. S. Department of Agriculture.

Citrus producers have come to count on leaf analysis to tell them how much and what kinds of fertilizers and trace elements their trees need for best yield.

For the analyses, researchers take similar leaves from fruitless branches, reduce them to ashes and test for content of nitrogen, potassium, phosphorus, copper and other elements. About 40 leaves make up a good sample.

The tests reveal directly what elements the plants have in abundance and what they are lacking.

As an example of how leaf analysis pays off, researchers found that when potassium is plentiful in leaves, orange trees produce large fresh-market-size fruits. When potassium levels are low, the trees bear much smaller, sweeter oranges suitable for juice. In spite of the difference in size of fruit, both kinds of trees produce the same poundage of oranges.

Thus, by varying the potassium in the soil around his trees, the producer can produce oranges to fit his needs.

much for them and it might be better to delay the dieting until they are adapted to their more restricted life.

WHO SHOULD NOT DIET?

The danger of emotional breakdowns during weight reduction cannot be predicted without psychiatric study, but the *Proceedings of the Staff Meetings of the Mayo Clinic* have called attention to some patients who are risky subjects for dieting

- A patient subject to moderate to severe changes in mood should diet with caution Certainly anyone who has had a real depression should be careful
- A patient currently heavily pressed by life situations and responsibilities should defer dieting, if possible, until the pressure eases
- For a patient who seems lonely and considerably deprived of companionship, strenuous dieting may be a real risk
- Women obviously already tense and anxious around middle life should be careful.
- Men whose retirement is imminent and who gain weight in their late 50's. Severe dieting may be too much for them and it might be better to delay the dieting until they are adapted to their more restricted life.

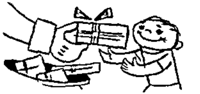
CHRISTMAS BLUES

Unconscious memories of coming out second best in childhood rivalry with other children may bring on attacks of mental depression in adults at Christmastime This explanation for "Christmas neurosis" was given by Dr. L. Bryce Boyer of Berkeley, Calif.

"Throughout Christian lands," he reported, "depressions are frequently associated with Christmas."

Findings in a study of 17 patients who suffered from signs of depression, or melancholy, at the usually joyous Yuletide, and who were given psychotherapy or psychoanalysis, showed Dr. Boyer the reason for the Christmas neurosis.

All of the 17 patients Dr. Boyer studied had suffered emotional deprivations during their early child-



hood. All had fared second best, or felt they had, in rivalry with brothers and sisters for affection and attention from the parents.

At Christmas these patients had made Santa Claus equal, in their own minds, with parents who gave presents The presents were love tokens but at the babyhood level these are feedings that satisfy hunger. →

"Thus, at least in America, Chrismastime was seen to be associated with a revival of old memories, unconscious to be sure, related to the infantile period of dependency for satisfactions of hunger needs," Dr. Boyer said.

MATES DISAGREE ON WHAT MAKES A HAPPY HOME

Husbands and wives agree less than half the time on what makes a satisfactory home. And the higher the income group, the more expensive the house, and the more extensive the education, the greater are the differences in opinion.

These facts were revealed in a year-long research project by Dr. James E. Montgomery, associate professor of housing and design at Cornell University, and reported in *The New York Times* by Betty Pepis.

One thousand husbands and their wives in the Buffalo area were asked

to answer identical questions on what makes a house a happy home.

Professor Montgomery, a sociologist specializing in housing, feels there are nine basic satisfactions that a house can provide. He worded his questionnaire to find out which of these nine qualities were the most important to husbands and wives.

The nine values are: prestige value, physical health, mental health, a thetic pleasure, provision for leisu equality (for different members the family), economy, family co sion, freedom to do as one pleas

Both members of a couple are u ally in agrement on the subject provision for leisure, which usua occurs during their hours togeth

What is surprising is that men a as interested in the aesthetic appe ance of a house as are their wiv (although this is supposed to woman's exclusive domain). A their wives, sometimes accused of b ing carelessly unconcerned abo practical matters, give the same im portance to economic values as their mates.

On matters of social prestige, co ples may disagree. It is the wife wh feels that a certain type of house in certain kind of neighborhood is im portant for social prestige.

And women are more vitally con cerned with encouraging good healt both physical and mental, throug careful design of the home. Probabl because they spend more time a home, women are more insistent on good light, ventilation and hea (which make for physical health) They also find acoustically treated interiors desirable, the soothing ef fects of which benefit mental health

Husbands and wives have differ ences of opinion on how close to the rest of the family one should live Women, in general, very much want to stay close to other members of their family. Husbands regard the matter as relatively unimportant in selecting a home.

HYPNOTISM MACHINE

An instrument to induce varying degrees of hynosis as a medical and dental aid is now undergoing clinical tests, reports Robert S Kleckner in the *Chicago Sun-Times*

Invented by electronics engineer Neil Slatter, the device requires the subject to sit in an easy-chair and look into a light-projector about six feet away. At the same time he dons a telephonic headset All he does is look and listen. The apparatus does the rest.

As he peers at the projector, a mellow greenish light decreases in intensity as he inhales his breath, increases while he exhales At the same time, as he inhales and exhales in rhythm, a sound tone increases and diminishes in volume.

At the beginning, the machine is set for cycles of audio-visual stimuli around 20 per minute, roughly the normal breathing rate Automatically and gradually that rate goes down to 12 or less The subject, without conscious effort, or even knowing why, adjusts his breathing rate to the speed of the audio-visual cycles of the machine.

As breathing slows, relaxation begins It comes on gradually. Within 15 to 25 minutes subjects are in the twilight of sleep, the best time either for autosuggestion, or suggestions from doctor or dentist.

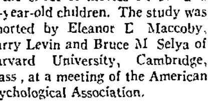
Tests have shown that the doctor or dentist can talk to the patient before undergoing the electronic relaxation and tell him what to think—"I'll have no pain when my tooth is pulled"—and the suggestion works. Or the dentist or doctor himself can give the suggestions by microphone when the completely relaxed stage is reached.

MOVIES' EFFECT DEPENDS ON MOOD OF AUDIENCE

Whether violence in movies and TV programs arouses anger and aggressive reactions in children depends on whether the children are already angry and in a fighting mood when they see the picture.

This is the conclusion of a study of the effect of movies on 10- and 11-year-old children. The study was reported by Eleanor E Maccoby, Harry Levin and Bruce M Selya of Harvard University, Cambridge, Mass , at a meeting of the American Psychological Association.

The children were all sixth graders. They were shown a chapter from a serial movie of the spy thriller type But first one group had been made angry and resentful. This was



done through spelling bees in which one team was consistently given easy words while the other team was consistently given hard words at about the ninth, instead of the sixth grade level.

The members of the team all hard words protested, spelling bee was unfair. W a week later, what they

of the movie, the victims of the unfair spelling test remembered more violent, aggressive scenes than the children who had the easy test.

P.O.W. TYPES WHO "GAVE IN"

Ex-prisoners of Korea who collaborated with the Communists or who are under suspicion of collaboration fall into definite personality patterns. This is the conclusion of Dr. Henry A Segal of Hyattsville, Md., from interviews with more than 100 defectors

Doctor Segal describes the patterns he repeatedly found as follows:

• The big dealers. The instincts of these men to be big operators were suppressed in military service, or so they believe, whereas their innate abilities were "discovered" by the Russians. They deluded themselves into the idea that to perform big deals for the Communists was doing themselves good, and indirectly, helping other Americans.

• The play-it-coolers. The great bulk of the middle-grounders whose training somehow taught them to follow the path of least resistance, roll with the punches. The Communists cleverly led these men step by step.

• The introspectives. The seclusive types who like to stay by themselves, reading. The Communists built up their egos as intellectuals.

• The dupes. These men were cleverly disarmed by their captors, who pretended to know beforehand the information they wanted to get.

• The scared kids. Terrified and homesick youngsters who, lacking moral, spiritual or religious resources, were easily browbeaten.

• The praise-starved egotists. The so-called misunderstood frustrates who had been subconsciously waiting for some superior to give them the praise they felt long overdue. The Communists fed them praise as a trainer feeds his seals.

Soft Drinks Show Up Heart Defects

Carbonated soft drinks have become an X-ray aid.

Doctors Victor Tompkins and John C. Macaulay of the New York State Department of Health, writing in *The Journal of the American Medical Association*, said that better heart photographs were obtained after subjects drank carbonated soft drinks.

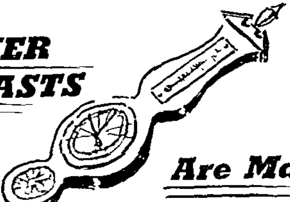
They said that downward heart enlargement often is hidden in X-rays by the stomach's dense shadow. They discovered a stomach bubble was produced when patients drank carbonated beverages.

This large gas bubble in the stomach eliminates shadow and makes more heart area visible in X-rays They said that as much as 32 percent of the front of the heart was invisible without the stomach bubble

With the bubble, the size of the heart was seen in a truer shape

—*Chicago Sun-Times*

How WEATHER FORECASTS Are Made



by E. John Long

Condensed from Nature Magazine

IT WAS ONCE SAID that the U. S. Weather Bureau would hire no women but blondes, using strands of their hair in delicate humidity-measuring devices. True or false blonde tresses are passé meteorologically speaking Humidity is now measured by a gadget imposingly named the infrared absorption hygrometer.

Of several ingenious instruments developed by the Bureau, its pride is a package-deal known as the Automatic Weather Observer This is an unmanned weather-listening post, designed to fill gaps in the present reporting network A version of the A W O will be placed on mountain tops and on offshore islands, where commercial power is not available

The basic principles of the Automatic Weather Observer were devel oped by the Germans during World War II. The Germans installed them in buoys released from submarines. The weather data sent back to Germany by radio proved of great value, not only to German submarine operations, but in forecasting weather for the battlefronts.

The Weather Bureau's Automatic Observer is a greatly improved version of the German prototype — a Rube Goldberg contraption capable of sending automatic reports on temperature, humidity, wind direction and speed, air pressure, precipitation, and the like. It needs servicing only once every three months

Already these Automatic Weather Observers have been hooked directly into the Bureau's teletype network. The two now in operation are located at Park Place, Pa , and at Sandberg, Calif.

In addition to daily weather forecasts, which the public obtains through daily newspapers, radio or TV programs, certain Weather Bureau offices issue special forecasts for airplane pilots, for forestry units fighting forest fires, and growers to protect their damage from frosts.

Twice each week,

Nature Magazine (Oct '55), published by the American Nature Association 1214 16th St , N W Washington 6 D C Copyright 1955

property damage kept at a minimum when American rivers flood over.

In river and flood forecasting, weather reports are coordinated with the reading of riverside gauges. In addition to daily river-level predictions for about 700 points on the main rivers of the United States, special warnings are made public when floods threaten Even the routine daily forecasts are used by those engaged in river navigation, water control, power production, and industries that use water power or water supplies. The records are studied by agencies planning to construct public works, such as dams, levees, or hydro-electric plants.

The Weather Bureau, in fact, has no "dead files." No weather observation nor statistic on temperature, air pressure, humidity, and such, is too old to be useful in computing climate and long-range forecasts.

The Bureau's own records have been supplemented by the reports of thousands of observations made by others More than 9,000 selected citizens, known as voluntary cooperative observers, keep daily records of the weather in their areas and mail them to regional weather offices These data finally wind up on punched cards, kept at the National Weather Records Center, Asheville, N. C., where they are sorted and summarized by machines for the use of the Bureau's analysts.

Meanwhile, as the Weather Bureau goes about its regular duties of forecasting weather and floods, some of the headaches of the weather business have been taken over by a new agency called the Advisory Committee on Weather Control The pur-

hurricanes, and similar experiments, to gauge their merits, and to try to measure where such controls may come out.

"We may achieve climate," O Henry once wrote, "but weather is thrust upon us."

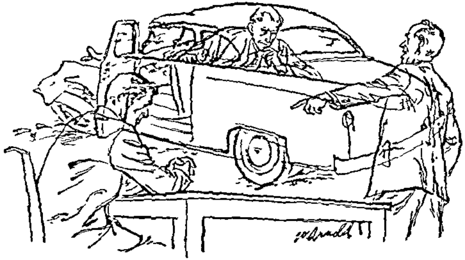
The committee has been delegated by Congress to determine whether that is necessarily so.

Hurricane Paths Are Shifting Towards New England

Hurricane paths have been changing in recent years, reports George S Benton, of Johns Hopkins University, in a recent article in *The Johns Hopkins Magazine*.

Benton, meteorologist and associate professor of civil engineering, says that "during the 19th century only six storms of tropical origin were recorded that 'seriously affected' the New England States," but that this record has been "equaled or exceeded in the last 20 years." He adds that what is true of New England is probably also true of the Middle Atlantic States.

Meteorologists do not know why this change has taken place. "All we can say is that at present we seem to be living in a period in which the boundary of 'hurricane country' has shifted northward from the Carolinas to Maine," Benton writes.



WHO SHOULD PAY FOR AUTO ACCIDENTS?

by Max E. Knight

Condensed from the California Monthly

If you should become involved in an automobile accident, the law would probably not be fair to you. The present law is such that the jury can rarely decide justly and according to the law. If you are the victim of an accident you may get a judgment for your injuries—if at all—only after years of expensive litigation, and once you have obtained that judgment, you may never receive compensation because the guilty driver was uninsured.

If you have caused the accident, you may be penalized—for a split-second of a technically faulty reaction at the wheel—in a way that may leave you bankrupt for the rest of your life.

And if you had nothing to do with the accident at all, but are involved in some other suit, you may have to wait, and wait, and wait — because the American courts are clogged with traffic-accident cases which make up at least 50 percent of their calendars!

This pitiful situation goes back to a legal principle which sounds reasonable when you first hear about it but is completely outdated, unfair, and inadequate when scrutinized. This principle, on which the present law is based, says: The victim of automobile accident can get sation only if a "rea in place of the driver,

California Monthly (May '55), published by University of California, Berkeley 4, Calif.

foreseen the harm. If the driver was "at fault" he must pay; if the victim was "at fault" he gets nothing

But what happens if neither is "at fault?" What if it is impossible to determine who was "at fault?" Then the victim—if he is still alive—limps home with his broken bones after years of litigation and pays his own hospital bills.

Let's see how the "reasonable man" concept works out in actual practice·

In 1938 a young woman in Pennsylvania was crippled for life when she was hit by a stone that had fallen from a building. The stone had been loosened three days earlier by workmen who had extricated a truck which, when hit by a car, had been propelled into the building. The woman sued the driver who started it all Could he have foreseen, in that split-second of an improper reaction, that he would force a truck into a building which would loosen a stone which would hit a passerby? This was the question the law asked the jury to ponder. The jury, disregarding the law, decided in favor of the crippled woman.

She was lucky. In San Diego, Calif, 8-year-old Barbara, was run down by a car whose brakes unexpectedly failed to work.

"Why should a man be punished," exclaimed the driver's lawyer at the trial, "who is not at fault?"

Barbara heard the words from a wheelchair. Having proved that she had crossed the street with the green light, her lawyer countered: "Who is ·re innocent, the man driving a faulty car, or this child who will limp for the rest of her life?"

It was of no avail. Barbara left the courtroom empty-handed. This time the letter of the law had won out: No fault of the injurer; no compensation for the injured But in millions of cases every year justice is dispensed by juries flouting that law, because the law is inadequate

Is justice dispensed even when the law is flouted? Deciding for the victim on the basis of his or her ability to arouse sympathy can hardly be called justice either. Courts have often awarded totally unrealistic amounts California reviewing courts have confirmed as "not excessive" $25,000 for two teeth and $73,000 for a broken nose. Amounts up to $100,000 have been awarded for the loss of a toe.

If in such cases the driver is not insured (the jury is not told whether he is or not, in order to elicit an "unbiased" decision), the court decision may ruin him. If he has nothing, the victim will recover nothing, despite the jury's verdict. If the victim does recover, the lawyer (his partner in the gamble more often than not) takes up to half of the "proceeds."

Now, the principle of "no liability without fault" has been expressly abandoned in the United States in favor of the American working-man who gets workmen's compensation for injuries suffered on the job regardless of whether or not the employer was at fault. The claws of modern machinery made this protection necessary. It has worked well for 40 years

Should the idea of workmen s compensation be applied to traffic victims? Should the man behind—and under—the wheel get the same protection as the worker on the job?

A practical automobile accident compensation plan worked out at Columbia University has been in existence—and ignored—for 20 years. But this plan which seeks the remedy in a scheme similar to that of workmen s compensation has been widely and effectively objected to on the ground that it would impede the sound growth of our legal institutions within a system of free enterprise through the encroachment of the state upon private insurance and the traditions of common law

> • It is imperative that laymen grasp clearly the accomplishments of science in this century, which are certain radically to affect man's future life on earth —President Dwight D Eisenhower

In his latest book, *"Full Aid" Insurance for the Traffic Victim· A Voluntary Compensation Plan,* published by the University of California press, Albert A Ehrenzweig, professor of law at the University of California at Berkeley attempts to achieve similar results by a voluntary plan of private insurance

Professor Ehrenzweig has spent a lifetime studying motor-vehicle liability laws in many countries won a Guggenheim Fellowship to continue his research, and has written several books on the subject.

The effects of his plan look as drastic as they turn out to be practical and fair to all parties Roughly they would be as follows:

(1) The injured would be entitled to a minimum co ; 'on regardless of who is at fault. He receives his money without a trial. If because of his social or financial status he considers the guaranteed amount insufficient he is free to take additional accident insurance

(2) If the injurer was criminally negligent the victim may sue for extra compensation against the liability for which the injurer could no longer insure himself, a fact which would contribute greatly to road safety Part of this "tort fine," however, would go into an Uncompensated Injury Fund which fund would be administered by the insurers themselves

(3) This Fund would pay compensation to those who even under the new plan would otherwise remain uncompensated as for instance the victims of a hit-and-run accident

(4) The morally blameless injurer would be free of any liability and of the worry and expense of a long-drawn litigation

The worker who trips over a welding line in the shop and knocks out his front teeth need not prove that his employer was negligent He gets his workmen's compensation, his teeth are fixed and his employer feels neither guilty nor cheated It is a normal risk in a plant for me- one to trip over a line

Well, it is a normal i' road for someone to g traffic. The reaction salesman is typical· enough to get

smashed and lose three weeks' work. But it was much worse to chase around for witnesses, confer with lawyers, and wait 15 months for the trial."

Millions of Americans get discouraged with that chasing, conferring, and waiting, and do not seek justice at all, or settle for a fraction of what they would be entitled to. If they stick it out, they find that their best case may crumble: they might not be able to establish—many months or years after the accident, and with fickle and perhaps corrupt witnesses—the speed, the distances, the fine points of the right-of-way; they might not be able to show that those split-second reactions of the driver contained that grain of "negligence," which here or there a jury might insist on.

• • •

Ehrenzweig's plan would pluck some features from existing experiments and try to avoid some of their mistakes. Here is how it would work:

Any owner or operator of an automobile who carries what the author calls "Full Aid" Insurance (because of the similarity to the First Aid Clause now written by automobile liability insurers) in statutory minimum amounts for all injuries inflicted by the operation of his vehicle, would, under the proposed Automobile Insurance Law, not be held accountable for his common-law liability for ordinary negligence (He cannot escape liability for criminal negligence). While such insurance would be voluntary, it contains enough inducements to secure its effectiveness by general acceptance.

The victim of an automobile accident would not have to prove negligence of his injurer. He would be entitled to a limited but adequate amount of compensation, without undergoing the ordeal, delay, and expense of a court trial. His compensation would be determined by fixed rates, keyed to the type of injury. He would, in other words, get so much for a severed hand, so much for a damaged spine, and—in general—so much per day for temporary or permanent disability.

In case of hit-and-run drivers or in other cases not covered in the general scheme, a special fund would be available from which such claims can be satisfied. Such funds already exist in several Canadian provinces and in North Dakota. And a law to the same effect was passed in New Jersey. Part of the money needed for this purpose could be collected from fines imposed on traffic violators.

Compensation sums would be high enough to permit the exclusion of court action in ordinary cases. Such action would be permissible, however, where the victim wanted to prove that the injurer was wilfully negligent. To make such additional claims effective as extra punishment for drunken or otherwise reckless drivers, no insurance would be permissible against such claims. If a driver wants to be reckless, he—and not the insurance company—will have to pay for the consequences.

This plan would protect the traffic

What It Takes To Be an AIRLINE PILOT

by Byron Moore

Condensed from a chapter of the book, The First Five Million Miles

A YOUNG MAN learning to fly today because he aspires to airline flying is taking a gamble If he reaches the qualifying amount of flying experience about the time the demand for pilots is great, he'll be lucky If the demand for pilots has slackened off when he reaches qualification, he'll probably never land that airline job Because even though able to continue building his flying experience, the chances are that when pilots are again in demand he'll have passed the age limit

United Airlines has tackled this problem in an intelligent and realistic manner In Denver they maintain a permanent flying school. Rather than stress previous flying experience, they choose their pilot applicants on the basis of personality, education, character, nervous stability, physique — qualities they feel tend to make a man a desirable employee—then give him a thorough training in their flight school From there he graduates into a co-pilot's seat

If one were to construct a "composite" airline pilot he'd ... a senior co-pilot or rese... his middle 30's, medium build, married, and w...

The First Five Million Miles copyright 1955 by Byron Moore and published at $3 75 by Harper & Brothers 49 E 33rd St New York

ceived his early flight training in the Air Force after a couple of years in college. He would be quiet-spoken and slow to express opinions: his reluctance to wax enthusiastic on the one hand or to express disapproval on the other would give him an air of aloofness or preoccupation. (Why prolonged exposure to flying does that to a man I can't explain, but it does.)

In dress and choice of automobiles he would tend to extreme conservatism and be careful with his money. The chances are that he wouldn't smoke at all but would take a drink on occasion. His recreation would run toward outdoor activities such as fishing or golf and he would attend church only after sufficient prodding by his wife. He would be an unobtrusive and friendly neighbor, but tend to mix socially with other airline pilots. While not aggressive he would have a well-developed stubborn streak and be a hard man to push around.

He would display a surprising lack of curiosity toward new ideas or other ways of life, his reading encompassing the daily newspaper and a magazine or two. He would worry a little about flunking a physical or not getting the assignment he hoped for, but otherwise would be friendly and well adjusted, tending slightly toward laziness. If he engaged in any outside studies or activities it would probably be something that would bring in money in case he lost his job for any reason.

If he sounds like a dull sort of person . . . well, make a composite of the members of any profession or trade union you're familiar with. See what I mean? I'm sorry if I've punctured any illusions, but this article is based on fact.

By no means do I mean to insist that all pilots are dull. In our ranks we can boast of generals, lawyers and men studying law, men active politically, explorers, prospectors, painters of no mean ability—even, not including myself, writers. Such men as the late Saint-Exupery, Wolfgang Langewiesche, Ernest K. Gann, Guy Murchie *(Song of the Sky)*, Peter Dollar and many others. But such men could hardly be called average in any line of endeavor.

With sufficient flying experience, a young man can start as an airline co-pilot if his visual acuity is 20/20 without correction, he has two years of college credits, and he can convince the personnel manager that he is of good moral character, cool headed, and capable of quick decision and consistent good judgment. Also in addition to a perfect physique, his actual physical dimensions must be within certain limits so that they'll fit airliner cockpits.

BYRON MOORE has worked at various [illegible] Corp., flying Loening amphibians across Lake Erie from Detroit to Cleveland. Mr. Moore joined American Airlines when Thompson was absorbed into the American Airlines System, with which company he has remained to the present. At the moment he pilots DC-7's non-stop across the United States.

The long, the short and the fat pilots who got on the airlines before the present rules were made, have to make their own cockpit adjustments. This takes a bit of bodily contortion on the one hand, and leg stretching and bolstering with pillows on the other. While these veterans of the odd sizes and shapes have possessed the stamina and ability to overcome their physical handicaps, the airlines feel that it is more economical to employ men who will fit standardized cockpits with minimum adjustment of controls.

That the airlines are prejudiced against men with military training is a misconception Most airlines favor military pilots, other things being equal, if only because of their experience with big engines and fast equipment. In general, airlines prefer applicants with a direct, pleasant manner who are quietly aggressive Even a slight cockiness, in a new man, if not flagrant, is acceptable, usually denoting pride in his ability

The cockiness will help tide him over the shock of his first winter of airline flying Most skippers smile indulgently when a new co-pilot starts out as an eager beaver. They've seen the cockiness of too many youngsters melt away in a thunderstorm; when they have to "read back" an involved airways clearance with lightning static crashing their earphones and St. Elmo's fire snapping angrily between the various metal fittings in the cockpit.

• The man in an airplane is not necessarily less devoted to truth, justice, and charity than his forefathers in oxcarts Virtue does not necessarily go with primitive plumbing, and human dignity can be nurtured in a skyscraper no less than in a log cabin —David Sarnoff

A new co-pilot goes to school for a couple of months before flying a schedule, learning the methods and procedures of his particular airline. After passing his flight and written tests, he is assigned to a route for a year, during which he puts in many hours of study, "flies" the Link Trainer (flight simulator) hour upon hour, and takes innumerable batteries of flight as well as written tests.

After two or three years as co-pilot he can qualify as reserve captain if he maintains his physical condition and can pass the test of the Civil Aeronautics Administration for an Airline Transport Rating —which is a stinker It includes, in addition to exhaustive written examinations covering the type of plane he is to fly and the route he is assigned to a flight test under simulated instrument conditions

During the flight test the applicant sits in the pilot's seat under the "hood"—a device which permits him to see the flight instruments but nothing outside the plane. Taking off "on instruments," the CAA inspector cuts an engine shortly after the plane leaves the ground, simulating an emergency To pass h the pilot must climb his plane to a safe altitude whil orders to the crew in prop so that their actions will plane not only to fly e to stay in the air.

For instance, he must order the landing gear raised quickly to eliminate its drag. He must know the exact moment to raise the wing flaps—lifting them too quickly could cause the plane to lose lift and fall, leaving them down too long creates drag which overworks the "live" engines.

He must "feather" the propeller of the dead engine so that it won't "windmill," holding the plane back, and he must close the cowl flaps and run through a check list covering a dozen or more operations to offset the effect of the dead engine. At the same time he must navigate a course, by instrument and radio (he can't look out the window when under the hood), which will keep the plane away from any mountains or high terrain.

After attaining sufficient altitude he performs, on order, various emergency and maximum performance maneuvers, recovery from stalls and unusual positions, and fire drills, among other things, to test the speed and accuracy of his reactions.

All this is done under tremendous pressure, pilots losing as much as five pounds during a test. Even for senior captains, who have to take the flight test twice a year, it is no hayride. An expression of airline pilots is that they "hang their jobs on a hook" a minimum of five times per year: twice when they take their flight tests (and some check pilots can be *tough*), twice when they take their government physical examinations, and once when given their annual physical checkup by the com- v physician

After five to seven years as copilot and reserve captain a man, on most airlines, can count on moving over into the left-hand seat as a permanent captain. By then he will usually have flown well over a million miles.

As new runs or pilot bases are created pilots bid for them on a seniority basis. Some pilots prefer a long run which, since they are not allowed by law to fly over 85 hours per month, affords them more time off. Others are more interested in the amount a run pays, night trips paying more than day. Other pilots will pick a short run that will let them spend each night at the home base Top pay for a senior pilot flying a night schedule runs to as high as $18,000 per year, though the average pay is much less.

Retirement age for airline pilots is set at 60, though few men continue flying until they are that old. Most fail to pass the rigid physical examinations before attaining the retirement age. Some, of course, go into ground jobs, though few pilots, due to the specialized nature of their work, make good executives. American Airlines as well as most of the other large airlines contributes to a retirement fund for their employees

Over the years flying has become a complicated business. Your modern pilot needs a great deal more than a set of normal reflexes and a cool head. His reflexes have been conditioned and reconditioned; yet he must retain his basic, seat-of-the-pants feel of an airplane.

If you picture the airline pilot sit-

ting silently in his seat, hands tense,

possibly reminding a green co-pilot to de-ice the carburetors, advising the stewardess of any anticipated delays, and so on Going still further, he reserves a corner of his mind for an alternate, or emergency, plan of action in case, to use pilots' lingo, anything goes sour

Bringing a man to a point where he can command an airliner requires years of supervised training. This costs a lot of money and the airline foots the bill

To pilots considering flying as a career, especially today, safety is rarely a factor. I think every young man believes implicitly in the indestructibility of his person; *his* scalp is never destined to hang from some Indian warrior's belt, *his* flesh will never be consigned to the sharks.

All pilots are occasionally asked the question: Is flying really safe?

There is no pat answer A well-considered reply would be it is both extremely safe and extremely dangerous, it ranges all the way between the extremes, depending on the type of flying in question, also depending on whom the degree of safety pertains to.

Quotes from two aviation magazines published a few months apart should be enlightening. The first is from *Aviation Week:*

> The Air Force and Navy don't like to tell the public how many airmen are lost in noncombat accidents, but some of the secret leaks out when the services go before Congress to seek bonus pay for especially hazardous duty. Here are some totals: The Navy alone in the last ten years has lost 12,000 pilots and crewmen in noncombat crashes. One out of four Navy pilots dies before completing twenty years of service.

The other, from the Douglas Aircraft house organ:

> **'52 AIRWAYS PROVE SAFER THAN ROADS**
>
> It's five times safer to (travel) by U S scheduled airlines than (go) an equal distance by automobile or taxi.
>
> The U S domestic and international airlines last year established their best safety record in history, carrying almost 31 million passengers a distance of more than 18 billion passenger miles
>
> They did the job with a fatality rate of 0 48 per 100 million passenger miles, compared with a rate of approximately 2 80 for autos and taxis.

From the second article quoted above it might be assumed that the airline pilot has a safer job than the taxi driver. It doesn't quite work out that way In the first place he's only 2 of up to 80 or more people aboard when an airliner crashes, which makes his chances, from the statistics, roughly 30 times greater This brings his fatality expectancy to 14 40 per hundred million miles, which is several times higher than taxi and auto drivers'.

No, even an airline pilot's job is not a 100-percent safe job. I don't think many of us would like our jobs if they *were* completely safe. T' is a tonic in danger that k... alert and young. If a man ... danger a factor in whether he wants to fly he can't afford to fly.

THE AMAZING DEAD SEA Scrolls

by Christopher Matthew

Condensed from the Milwaukee Journal

ONE DAY early in 1947 a Bedouin boy named Mohammed the Wolf roamed the parched hills in the Wadi Qumran near the western shores of the Dead Sea, looking for a lost goat. Tired of the search, he began throwing stones at a hole in the cliff opposite him. One stone whizzed through and hit something that broke into pieces.

It was an eerie sound in that lonely country, and the boy fled. Later he returned with a companion and climbed through the opening into a cave filled with broken pottery. Eight tall clay jars were unbroken, and in these the boys found tightly rolled scrolls wrapped in linen. One which they unwound was 22 feet long. It was covered with two columns of a strange script, later found to be Hebrew.

Unknowingly the boys had stumbled upon the "Dead Sea scrolls," now called the "Qumran Manuscripts," the most important archeological find since the Renaissance.

The young Bedouins took the eight scrolls and returned to their herds. They were smugglers who had detoured far south in order to avoid paying the customs levied at the Jordan bridge on all commodities brought from Jordan into Palestine. They did not know that the law of their country also required them to report any antiquarian find to the government.

In Bethlehem they sold their goats to a trader and tried unsuccessfully to sell the manuscripts to him for 20 pounds. Another trader, a Syrian, suggested that they show their scrolls to the metropolitan of the Syrian monastery in Jerusalem. There the boys went some months later, after the metropolitan had sent word that he was decidedly interested. But they arrived while he was out to lunch and were turned away by a priest who later reported to his superior that some "tough looking Arabs with dirty scrolls containing Hebrew script" had been there.

On their way home, the Arabs

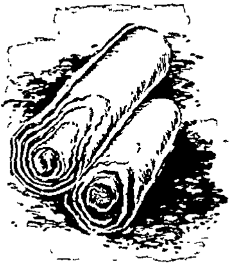
he Milwaukee Journal, Milwaukee 1, Wis.

bargained to sell their treasure to a Jewish merchant, but the excited metropolitan got in touch with them in time and persuaded them that he had prior claim They let him have five scrolls for a reputed 50 pounds. The other three had been bought by the Syrian trader, who sensed they were valuable. He in turn had disposed of them to the Hebrew University on Mount Scopus in Jerusalem.

By this time news of the discovery had been reported to the world. Scholars were already busy arranging for publication of photostatic copies of the metropolitan's scrolls. War had broken out between Arabs and Jews, and the Syrian monastery was in the range of shellfire. The metropolitan was advised to bring his scrolls to America, where he could sell them at a good price. He came here in 1949 and exhibited them in the Library of Congress, but found no buyers Publication of the photostatic copies seemed to have lessened the value of the originals.

Then, late last year, an emissary from Israel appeared in New York and bought the scrolls for $250,000, the money being supplied by American Jews Last February 13, Premier Sharett of Israel announced that the Qumran Manuscripts were then in Jerusalem and that a museum to be known as the Shrine of the Book would be built to house them Thus the eight scrolls, after the vicissitudes of eight years, were together again, as they had been 2,000 years previously.

Meanwhile, the discoveries in what had become known as Qumran cave



INSCRIBED COPPER *rolls as they looked when found in Cave 3.*

1 had touched off a search for old manuscripts that became as intensive as a uranium hunt The 700 Bedouins who lived in that Dead Sea area scoured cliffs and *wadis* (dry stream beds), hotly trailed by archeologists and police The latter were under orders from G Lankester Harding, British director of Jordan antiquities, who was determined that the law concerning ancient finds should be observed. However, the nimble Bedouins had a big advantage over jeep-borne police in the desolate country

In 1951 it became apparent that the Arabs had struck another archeological gusher, for a number of literary fragments were being
for sale. Archeologists, con
old manuscripts more imp
modern laws, paid asking
without inquiring too clc
finds had been reported.

their number, Pere R. de Vaux, head of the French School of Biblical Archeology in Jerusalem and a key man in the field, wormed the secret of the new treasure-trove out of a number of Bedouins.

He then led an expedition to the caves where the finds had been made — at Murabba'at, about 15 miles south and west of Qumran. When his party arrived, some three dozen Bedouin diggers scampered away. Most of them were promptly hired to do legitimate digging, and a few, while waiting to be searched, tried to unload looted fragments on Father de Vaux.

Between Arabs and archeologists, about 367 caves had been discovered up to last spring. The largest at Marruba'at are 15 feet high and 150 feet long. Many had to be excavated. Only 37 showed traces of human habitation, and only about a dozen yielded anything of value. The most important finds were made around Qumran. In cave 3 were two copper rolls, oxidized to such an extent that they will have to be treated chemically before they can be unrolled. Another cave contained 500 Roman coins. The latter are very valuable in helping date the finds.

But the biggest of the later treasures was found in cave 4, though it was sadly damaged and buried under debris. The thousands of manuscript fragments there reminded author Edmund Wilson, who visited there recently, of "autumn leaves that have lain in the forest all winter."

The 3-year-old daughter of Frank Cross, one of two American members of the international manuscript committee, got another impression: "Who tore up the book?" she asked

The task of salvaging and reconstructing the jigsaw puzzle of these bits of parchment requires an enormous amount of skill and patience But it is proceeding and should be finished in five years. Whereas cave 1 yielded only the complete Hebrew manuscript of the book of Isaiah, the mutilated manuscripts of cave 4 contain parts of every other Old Testament book except Esther.

Biblical scholars almost immediately recognized the significance and high antiquity of the scrolls, but they were not at first sure who had placed them in the caves and why The answer came with the excavation, between 1951 and 1953, of a ruin near the Qumran caves. It disclosed a community center of the ancient Essenes, a monastic, pre-Christian Jewish group that thrived from about two centuries before to one century after the birth of Christ.

Among the features of the ruin were a number of apparent cisterns (some think they were grain bins), a cemetery containing 1,000 graves, and a scriptorium complete with plaster table, ink pots and plaster basins, the latter presumably for ritual washings before each scribe began working Here was the very spot where the scrolls had been written—and the place where the scribes had been buried. The caves had served as libraries and vaults for the Essenes.

At the time of the first Jewish rebellion against Rome—A.D. 70—the

scribes sealed their manuscripts in the caves, hoping to save them for happier days, which never came, for their community was destroyed by the Romans soon afterward

• • •

The Qumran Manuscripts are chiefly of two kinds—those containing parts of the Hebrew Old Testament and those containing Essene writings The first among which the prize piece is the wonderfully preserved Isaiah of cave 1, are important in studying the text of the Old Testament. Already a dozen changes in the revised standard version of the Bible have been based on them Our oldest Hebrew manuscripts of the Bible up to 1947 dated only from 916, because it was the practice of rabbis to burn their worn-out manuscripts after copying them The Qumran Bible manuscripts are a thousand years older

In general the manuscripts reveal few divergences from the text of our Bible The Hebrew scribes did an excellent job of copying through the centuries Yet they made a few slips The New Testament, for instance, several times quotes passages from the Old that cannot be found in our present Bible One such supposed quote was the verse of Hebrews, 1-6. "Let all God's angels worship Him " This passage appears in the new manuscript fragment in Deuteronomy, 32. It had been lost somewhere along the line by later copyists.

Even more important are the Essene writings, especially a *Manual of Discipline*, a *Commentary on the Prophet Habbakuk*, and the *War Between the Children of Light and of Darkness* A French scholar, A Dupont Sommer, sparked an international controversy when he wrote that the main essentials of Christianity can be found in the Essene books To some it seemed that "the uniqueness of Christ was at stake " The fear was exaggerated. Dupont Sommer had based his chief argument on a mistranslation and an interpolated passage The Essene writings will not overthrow traditional church doctrine, but they will enrich our knowledge of how it came to be

The gospel according to John used to be considered the most Greek of all the four gospels Now it seems to be the most Jewish of all. Many of its teachings seem to have been formulated consciously against those of the Essenes As for some remarkable parallels in phraseology, it is a case of the Essenes supplying old bottles and of the evangelist pouring the new wine of the gospel into them

The ablest Biblical scholars in the world are hard at work editing and appraising the Qumran Manuscripts and resolving the controversies that have arisen over them.

MORE than a million and a half tons of odorous sulfur dioxide gas—from which 2 2 million tons of furic acid may be formed—are poured into the atmosphere each year, according to Dr Morris B J of the lab of the New York Department of Air

BUG JUICE of MANY USES

Condensed from Industrial Bulletin of Arthur D. Little, Inc.

EACH YEAR some 2.5 trillion insects are born, live, and die for no apparent purpose other than man's pleasure and comfort. With a minimum of human assistance, these bugs produce over 50 million pounds of a resinous material that man has never been able to match. Man has, however, used this "bug juice" in a refined form known as shellac, for perhaps 4,000 years.

During World War II when supplies of shellac were cut off, one company developed a protein-based substitute that satisfied many users. This product, Zinlac, and a few others introduced later, but in lesser quantities, kept the shellac industry going for about five years. When the natural product returned to world markets, substitutes were dropped, but the technology remains available.

Crude lac is a scale-like, amber-colored, waxy, resinous substance exuded by *Tachardia lacca* to serve as a protective coating for the insect's soft body during the major part of its six-month life span. The insects live as parasites on trees chiefly in India, Thailand, and Burma. The lac is "harvested" four times a year from the branches to which it adheres Once separated from the twigs, the crude lac is ground, washed, dried and graded according to particle size. The coarsest size, known as seedlac, is purified and refined by heat or solvents into various grades of commercial shellac. About half the world production is consumed in the United States.

The most familiar uses for shellac are as a quick-drying, hard-wearing finish for wood, and as a sealer coat prior to finishing. Shellac is soluble in quick-drying solvents like the lower alcohols, and from these solutions, thin, tough coatings can be formed in and on the surface of the wood. Shellac is also used to give better adhesion and toughness to nitrocellulose lacquers for difficult surfaces on some metals and plastics.

Most shellac is orange when imported, and must be bleached for some applications, such as quality wood finishes, coated playing cards, and specialty papers. The principal constituents of shellac are soluble in alkaline water; once dissolved, the shellac can be bleached in much the same manner as the sheets in the Monday wash.

Industrial Bulletin of Arthur D. Little, Inc. (July '55), Cambridge, Mass.

To recover the bleached shellac, the solution is acidified, and the shellac settles out. Alcohol solutions of the resultant granular material are cloudy, because the wax contained in the shellac is insoluble in alcohol, but when a completely clear shellac is required the wax is removed

Perhaps the largest single use for bleached de-waxed shellac is in self-polishing floor waxes a typical formulation is an aqueous solution of bleached, de-waxed shellac into which a small amount of modifying wax has been emulsified This type of shellac came along at about the same time that vinyl plastic took over the field of phonograph records, an end-use that had threatened to monopolize the entire world supply of shellac

Shellac can be found in a number of other important uses. It is used, for instance, in inks for printing on such smooth, non-porous surfaces as glassine, metal foil, and so forth. It is also used for cementing felt and wool in hat manufacture, for leather finishing, for protecting the silver backing on mirrors, for setting coiffures, and for bonding the abrasive particles in grinding wheels.

Its excellent electrical properties make shellac especially suitable as a molding material for insulating parts Some highly refined shellac is used to impart a colorless, tasteless glaze to candies to prevent sticking, but its use in pharmaceuticals is of greater importance.

Pills have long been coated with shellac for improved appearance or to hide unpleasant taste. More recently, shellac has been used as a coating for pills that must pass from the stomach to the intestines before dissolving, since shellac has excellent resistance to acids in the stomach

Women's Clothes Are Safety Hazards

Women's present fashions have been labeled a safety hazard by the New York City Transit Authority, according to a dispatch by the United Press Tight sheath skirts, sling pumps and slippery fabrics are the worst offenders.

About 32 percent of all transit passenger accidents involve falling on or off buses, a transit spokesman said. Tight skirts and sling pumps are to blame for many of these, he added

"Women, trying to step from pavement to bus step, find their lifted foot caught an inch or two short of its destination," he said "The result has been an epidemic of bruised knees"

The sling pump is inclined to fall off when its wearer steps daintily down from a bus As a result, she falls flat on her face, the transit authority said

Slippery new fabrics were blamed by the authority for many of the tumbles taken on board buses A total of 35 percent of all transit accidents are caused by bus movements, the spokesman said

"The sway of a bus rounding
ner, even at moderate
caused women to slip out of
to the floor," he said

FEVER'S NOT AN ILLNESS, SAYS MEDIC

Mothers panic over it and strong men take to their beds. But the danger of fever is greatly overrated, says Dr. Joseph A. Wells, Northwestern University pharmacologist.

A fever is not in itself an illness. This misconception probably comes down from the early days of medicine when diseases like typhoid fever and scarlet fever were named for it.

A fever is not always even the symptom of an illness, for mysterious fevers may occur for which no bodily disorder can be found.

Another false notion, says Dr. Wells, is that fever means the body is producing an overabundance of heat. Actually, it is a problem of the body not properly ridding itself of heat as it develops.

The heat retention stems from a narrowing of the blood vessels of the skin. The reason for this is not too well understood, but a probable explanation is that the toxins from the infectious bacteria in the body upset the brain thermostat, which in turn constricts the vessels.

Another misconception confuses temperature and fever. "Everyone has a temperature," says Dr. Wells, "but not everyone has a fever."

Linked to this is the misbelief that everyone should have a "norr temperature of 98.6 and that thing over this constitutes a feve

Doctor A. C. Ivy of the Univer of Illinois once demonstrated, in ing temperatures of 276 medical dents, all healthy, that their " mal" temperatures ranged from to 99 4.

Another belief for which Dr. W can find no supporting evidenc that fever is valuable becaus "burns out" the infection. This cept probably got started when was found that fever did dest *spirochetes of syphilis, he says* hasn't been proved in other disea however, but the belief still h among some physicians.

Therapeutic drugs have been vised for the purpose of inducin fever in an ailing patient and b ing out the disease.

Another curious notion held many is that the height of the fe measures the height of the illn and that by reducing the fever reduce the severity of the illness.

This is probably a holdover fr the day medicine did not have m prognostic tools and fever was ado ed as a measuring rod.

ME

ress

CINE

by Arthur J. Snider

The chief purpose in reducing fever is to make the patient more comfortable. When the temperature goes extremely high—106 or 107—it is important to bring it down rapidly because tissue cells cannot survive In such cases, a person should be sponged with alcohol or cold water until the physician comes, Dr. Wells advises

Babies' temperatures are difficult to fathom They vary greatly because their heat-regulating mechanism is not fully developed

ANTIBIOTICS, SULFAS HAVE SAVED 1.5 MILLION

In the 15 years since sulfa drugs and the antibiotics have gained widespread use, more than 1 5 million lives have been saved, in the belief of Dr. C C Dauer, medical adviser in the U S Public Health Service. Almost thre-fourths of those saved would have succumbed to pneumonia and influenza, he said.

Doctor Dauer estimates lives of about 76,000 mothers with childbed fever or infection also have been saved, and about 136,000 persons with syphilis and 90,000 with appendicitis owe their lives to the drugs.

BIG YEAR AHEAD FOR SALK VACCINE

Preliminary results from the 1955 polio experience have indicated the Salk vaccine has been effective in reducing paralysis and death.

The largest decline came in the eight states that had given 75 percent of the second shots reported in the country. They were Florida, Georgia, Louisiana, Mississippi, Oklahoma, South Carolina, West Virginia and California.

Doctor Herman E. Hilleboe, New York State health commissioner, reported there was a "significant difference" in the comparison of vaccinated and unvaccinated children in the matter of paralysis

And Secretary Marion B Folsom, Department of Welfare, reported data on 7 million vaccinated children showed cases of the disease running from 25 to 50 percent less than the rate among non-vaccinated children.

In addition to its apparent effectiveness, the vaccine has proved to be undeniably safe Improvements have been made The production and testing problems that handicapped the 1955 output have been overcome. Hundreds of thousands of additional children and m adults will be vaccinated befo start of the 1956 season.

Meanwhile the National

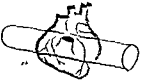
tion for Infantile Paralysis points to a number of problems that must still be solved. It is still not known how long immunity will last and how often children will need inoculation.

There is search for a strain of virus less virulent than the Mahoney strain from which the vaccine is now made.

Whether or not vaccinated persons can become symptomless disease carriers is not yet known. There also is search for a drug that will cure the disease in a person who comes down with it. Studies are being conducted on developing a test to determine as quickly as possible whether any suspect illness actually is polio

NEW TEST DETECTS HEART MUSCLE DAMAGE

A new test to determine whether the heart muscle has suffered any damage following a coronary attack has been devised by Drs. Daniel Steinberg of the U. S. Public Health Service and Bernard Ostrow, George Washington University.



It depends on the amount of an enzyme found in the body. The enzyme, glutamic-oxaloacetic transaminase, is said to be two to ten times above normal concentration in patients who have had heart muscle damage. The enzyme is believed to be released from the heart tissue in which it is ordinarily present in high concentration Results thus far show ~ 90-percent accuracy.

NEW X-RAY DEVICE STOPS HEART'S MOTION

A speedy new X-ray device that will "freeze" the heart in motion has been developed. It promises clearer pictures and opens the way to even greater advances in the exciting new field of heart surgery. The device can make exposures lasting only a thousandth of a second. Most conventional X-ray cameras shoot at about 1/60th of a second.

Doctor Charles T. Dotter of the University of Oregon told the American College of Radiology that while a patient is usually able to hold himself still when undergoing an X-ray, he can't do anything about his heart which continues to beat. Because of this movement, the finished film often comes out fuzzy.

Because of the camera's speed, it also is expected to be valuable in taking X-rays of fidgety and frightened children and of patients whose illness, such as shaking palsy, ordinarily does not permit clear detail

RADIOACTIVE GOLD FOR OVARIAN CANCER

Treatment of cancer of the ovary, thus far one of the most disheartening in terms of patient survival, may be aided with radioactive gold, according to a University of Iowa radiologist.

Doctor H. B. Elkins said the gold is applied through a needle or tube following surgical removal of as much of the cancerous tissue as possible.

Cases haven't gone long enough to measure results, he said, but "we

feel that the technique shows promise of increasing the survival rate,' he told the American College of Radiology.

Only about one out of three ovarian cancer victims lives as long as five years under present methods

CAREER WOMAN'S HEART HEALTHIER THAN HOUSEWIFE'S

Long-established concepts that coronary artery disease and high blood pressure afflict chiefly executives does not hold true in the case of women, a Chicago study shows.

A survey of 13,000 heart deaths by Dr. Jeremiah Stamley of Michael Reese *Research Institute shows* professional women such as executives, artists, teachers and lawyers have a much lower death rate from heart disease than housewives

He believes one reason may be in *the diet Housewives may be eating* foods overly rich in fats and lacking proteins, vitamins and minerals.

This may also account for the reason Negroes, both men and women, have a higher death rate from heart and artery disease than whites

MISCONCEPTIONS ABOUT PREGNANCY ARE EXPLODED

That a baby will be "marked" as a result of a frightening experience during pregnancy is a "figment of a fertile imagination," says Dr. John Parks, obstetrician at George Washington University, Washington, D. C.

The old saying "for every baby, a tooth" is lost by the mother also is a misconception The fetus does not absorb calcium from the mother's teeth.

Another prenatal fallacy is the feeling that the mother must eat enough for two, Dr. Parks said. Muscle and bone building proteins and minerals are needed, but caloric requirements are certainly not doubled by pregnancy.

Many mystic signs and pseudoscientific methods for determining the sex of the infant before birth *have been devised To date, there is no way to tell the sex of an infant* until it is seen at birth

A general belief among many patients and some physicians, too, is that most babies are born at night. This is not true, Dr. Parks contends Labor frequently begins or ends during the night, but the actual birth occurs equally, if not a bit more frequently during the day.

Beliefs that breast feeding causes a large appetite, large breasts and a flabby waistline also are untrue, the obstetrician points out in the *Journal of the Kentucky State Medical Association.*

Age is a source of concern in pregnancy, particularly for the per past 35 or 40 While it is tr the time of greatest obstet occurs in women 20 to 24 in pregnancy at any ag very great, Dr. Par

women past 40 have a better than 200 to 1 chance of surviving childbirth. Normal pregnancy at any time improves rather than impairs health.

LONGEST VESSEL GRAFT MADE OF SYNTHETIC FIBER

An 18-inch graft, longest ever placed in a human, has been placed in a 50-year-old patient whose femoral artery in the thigh was blocked through arteriosclerosis. The synthetic, dacron, was used because no graft of tissue was available for transplant.

Doctor Ormand Julian of St. Luke's Hospital, Chicago, said the patient had been complaining of pain after walking a short distance. Diagnostic studies showed that the blood was not getting down to the foot because of the long segment of blocked,

hardened and thickened femoral artery. Gangrene and possible loss of the leg would have resulted if the condition continued.

In recent years, surgeons have performed a nerve-cutting operation that seeks to relieve pain by inducing the blood to travel through smaller, secondary arteries in the thigh. It is not always successful. More recently, grafts of veins taken from the patient's own leg or of artery taken from a frozen-artery bank have been tried. The length of graft needed in this case prohibited their use.

Doctor Julian said the dacron graft will serve as a scaffolding through and around which the body will build new artery tissue.

"HUMPTY DUMPTY" VIRUS PUT TOGETHER AGAIN

A "humpty dumpty" feat of splitting a virus and then putting it back together so that it was capable of causing disease again has been achieved by a group of scientists at Washington University, St. Louis.

Doctor Barry Commoner reported the development as having potential significance in disease control. It might be possible to create new and desirable kinds of viruses, conceivably capable of killing cancer cells without harming the rest of the body, he said.

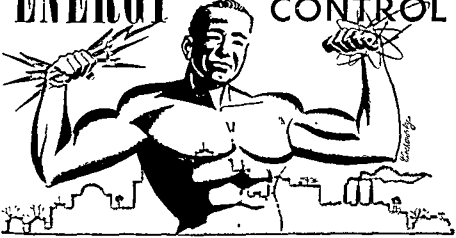
KIDNEY STONES ARE "SOUNDED" OUT

The method has been used so far only on cadavers but it may be possible to remove kidney stones by ultrasonics rather than surgery, according to Drs Harold Lamport of Yale University and Herbert Newman, Gouverneur Hospital, N. Y.

In experiments, they have passed high-frequency sound waves through the urinary passages to the stones in the passages or near the kidney. The stones are fragmented, then flushed out.

First few animal experiments indicate no ill effects from the ultrasound drill, the doctors report in the *Yale Journal of Biology and Medicine*. They expect that trials on patients may be warranted within one to two years.

ENERGY CONTROL



. . . KEY TO PROGRESS

by George R Harrison

Condensed from The Atlantic Monthly

HOW MANY MEN can live on earth at once, and how long and fully they can live, depends on man's ability to control energy and matter.

In an economy in which most people are farmers, the energy controlled by humans is stored in food and feed These consist of complex molecules whose production involves the waste of more than 99 percent of the solar energy showered on the plants in which they grow, and their use entails much further energy loss In many countries most work is still done by using the human body as a converter of chemical into mechanical energy, with wife and bullock of nearly equal importance Storing energy in starches, sugars, and fats to be later released in the sweat of man's brow is expensive, inefficient, and if overdone, uncomfortable.

Because we in the United States now do most of our work with machines that take energy from simple sources, each citizen can have 2,000 times as much energy working for him as was available in 1800. And today each man, woman, and c
in the United States has
horsepower working for
night, instead of the 2

The Atlantic Monthly (Sept 55) 8 Arlington St Boston 16 Mass

1900 With only 7 percent of the world's population, we control almost half of its supply of power, and as a result our standard of living is 7 times the average of the rest of the world.

Our ability to convert energy efficiently from one form to another continues to increase rapidly. Forty years ago 1 kilowatt-hour of electrical energy could be obtained from about 3.5 pounds of coal. Today only 1 pound is needed, and 12 ounces will soon be enough.

One kilowatt-hour of electric energy costs only a few tenths of a cent to generate with either burning coal or falling water, but it usually costs ten times as much when delivered to the home. Most of the extra charge is for transmission costs, and for the privilege of turning the power on or off at will.

The age of nuclear energy will bring great savings in energy transport, for a pound of uranium carries more releasable energy than 1,500 tons of coal.

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All of the energy we use, except "atomic energy," comes from the sun. Three fourths of it came to earth ages ago, and was stored first in the leaf cells of plants and later in coal, oil, and gas deposits, which we now are rapidly depleting. The other fourth, including water power and the energy stored in the molecules of foodstuffs, made its eight-minute journey from the sun only recently.

This glowing globe sends us 20,000 times as much energy as we use now for every purpose—energy equal in a single day to that released by 2 million atomic bombs of the Hiroshima variety. But we don't know yet how to capture and store this energy effectively enough to make it worth using in large quantities, except through storage by nature in plants and in the clouds. Both of these processes are, of course, very wasteful.

We use energy in three principal ways. In America, roughly a third is used to heat homes and factories, another third goes to process matter in mining and industry, and the remainder is spent in moving ourselves and our possessions from place to place in ships, airplanes, autos, trains, and streetcars.

Until 1880, most of the energy used by man came from burning wood, which was replaceable. Since then we have relied on irreplaceable coal, oil, and gas.

Seventy billion barrels of oil have [illegible] will near exhaustion by the time another generation has passed. Geophysicists are still able to find oil faster than the world can burn it, but their hunting methods must constantly be made more sensitive; and

[illegible]

how long they will be able to keep this up is anybody's guess.

When all the oil wells do go dry, oil shale, a mixture of rock and petroleum, of which enough is in sight to keep industry going for a hundred years or so, can be processed for fuel After this is gone coal can be hydrogenated, though at some loss in efficiency, to form liquid fuels The coal in sight may last the world for a thousand years

Water power is appealing because it is clean, can readily be converted into electric energy, and is constantly being replenished by the evaporation, caused by solar heat, of water that falls again as rain. It is not cheap to collect, however, and only 5 percent of the energy now used in the United States comes from this source If all the potential dam sites were developed, the resulting power would fill only one fourth of our present needs

Despite the advantages of oil and coal, more wood is cut for fuel today in the world than ever before However, in forward-looking countries wood is becoming more valuable as matter than as a source of energy All the cellulose our forests can produce will soon be needed for lumber and paper, and for rayon and other fibers made from cellulose molecules

AMAZING FACTS ABOUT ENERGY

One kilowatt-hour of electrical energy is obtained from a pound of coal

Each man, woman, and child in the United States has 10 horsepower working for him night and day.

A pound of uranium carries more releasable energy than 1,500 tons of coal.

Solar energy that reaches the earth in a single day equals that released by 2,000,000 Hiroshima A-bombs

All of the electrical power now used in the United States could in theory be produced from 60 tons of uranium

There are several vast sources of energy that we do not now find it worthwhile to tap Inventors have always dreamed of using the energy of the wind Even a minor hurricane releases energy as fast as a thousand atomic bombs exploding each second. But this power is hard to harness, and a source of energy, to be industrially useful, must be dependable and not too variable in output.

Much energy is stored in ‘’ ocean, as temperature di ... tween the warm surface - depths, in waves, and ... The great size needed

storms have in the past kept installations for collecting energy from the ocean and waves from being successful.

Recently we have become increasingly aware of two great sources of energy that appear inexhaustible: the sun and the nuclei of atoms. Will solar or nuclear power run the industries of the future? The answer is: Both, plus all the energy sources we exploit at present.

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The matter in an atom is all energy, as Einstein indicated in 1905 with his famous formula $E=mc^2$. Scientists have now learned to release about one thousandth of this energy by the process of nuclear fission, and as much as a hundredth by nuclear fusion

A pound of U 235, the isotope of uranium which, when separated from ordinary uranium, was first found able to support a nuclear chain reaction, can be made to release as much energy as 3 million pounds of coal gives when burned.

But only 1 atom out of 139 of mined uranium consists of this isotope. This scarcity is offset by the fact that U 238, a more plentiful isotope, can be converted into plutonium atoms, and the newly produced atoms can then be used as nuclear fuel.

The development of the breeder pile, which produces this nuclear fuel, has greatly increased our visible energy stores The operator of a breeder pile is somewhat in the position of a householder who shovels coal and ashes into his furnace, heats his house adequately, and then shovels out, instead of ashes, tons of coke that he can sell to the neighbors

If it were not for the dangerous radiations produced by its activity, a nuclear reactor could be rather light. As it is, heavy shields are needed to protect its operators from radiations which, besides being directly damaging to living cells, produce lethal rays when they strike sand or air or any other surrounding material.

The automobiles powered by "pea-sized plutonium engines" predicted by some journalists have lost much of their appeal because of the necessity of placing a concrete shield several feet thick under the driver's seat, and of providing heavy concrete fenders to protect the passers-by.

Any nuclear reactor must be carefully supervised in its operation, because of the dangers of contamination from waste products that might escape after an accident. This dampens our enthusiasm for nuclear-driven locomotives. Mopping up contaminated wreckage is a tedious and, if care is not taken, a dangerous job; and it is not always feasible.

Airplanes driven by nuclear power seem practicable if the shielding problem for personnel can be solved, as by putting the power plant in a tractor plane, and the pilots and passengers into one or more gliders, far enough behind to escape dangerous rays.

Ships are already being driven by nuclear power, though their ability

to carry enough stored energy to propel them for life will be limited by the need for occasionally sifting out nuclear ash from the fuel.

Reactors to produce electric power from nuclear fuels are now being built both here and abroad, and some soon to be designed should give enough power to fill the needs of the largest city. All of the electrical power now used in the United States could in theory be produced from the energy in 60 tons of uranium

Nuclear power can already compete with domestic power costs for fuel and upkeep where these are above 2 cents a kilowatt-hour wholesale, but the first cost and carrying charges are too high at present.

- There is no greater necessity in the world of today than a closer understanding by the politician and the citizen of the motives and methods of science, and by the scientific worker of the inevitability of politics and the responsibilities of citizenship — Sir Robert Watson-Watt

There is a great deal of uranium in the world A few years ago, when only uranium atoms of the U 235 isotope seemed fit for industrial energy release, the nuclear fuel in sight was equivalent to about 600 billion tons of coal, or one sixth of the world's reserves of fuel The breeder pile, however, has raised visible nuclear energy reserves to the equivalent of 90 trillion tons of coal, and our visible energy store of all kinds is increased perhaps 25-fold over what could be seen a few years ago

The sunlight that falls on a single acre of earth contains enough energy to keep a thousand people healthy, active, and comfortable Instead of doing this, most of it is wasted, and the remainder now serves only one or two persons. A 16-mile-square area in any desert receives enough sunshine to satisfy all the energy needs of the American people today. Thus there is lots of solar energy, but we lack a cheap and efficient method of storing it in quantity.

And all of the many methods of catching sunlight suggested thus far have been found to be too complicated, too inefficient, or too expensive to be practical for industrial use Most new-fledged solar-energy hunters are smitten with the idea of concentrating sunlight with mirrors A horsepower per square yard looks very attractive to this group as an inflow of power

Let's put up a reflector 10 yards on a side and concentrate 100 horsepower to run a steam engine! But large mirrors are costly and fragile, must be kept clean and free of dust, and must be turned to hold the sun's image still as the earth rotates A boiler with all the needed gadgets and a mirror large enough to produce only 2 horsepower on a sunny day costs about $1,000.

There is some hope that better methods of conversion can be found Greatly encouraging was the announcement in 1953 by scientists of the Bell Telephone Laboratorie
a new cell made of thin strips
cially treated silicon gave
watts per square yard w
to sunlight This efficie

cent has since been increased to 8 percent.

We may be on the verge of using solar energy far more widely for heating our homes and hot water. Solar houses have been operated through the winter even in New England with only a 10-percent addition of furnace heat. For such applications sunlight need not be concentrated, but can be allowed to fall directly on blackened metal absorbers on a house roof, tilted at the best angle to soak up heat during the winter months.

Such collectors now cost about $2 a square foot; if their cost could be cut in half, solar heating would become very attractive.

It has been suggested that furnaces could be run on algae or other simple plants grown for fuel. This would be a ridiculous waste of effort, involving building up at great expense very complicated molecules to do a job that much simpler molecules could do more effectively. Stoking stoves with starch or sugar is as silly as it sounds.

Energy from the sun, though it comes from the nuclei of atoms, by the time it reaches the earth has been made diffuse enough to be safely fed to the delicate complex molecules from which plants and later animals are formed.

When nuclear energy is released on earth, it is concentrated and intense, and to gentle it we must control great quantities of dangerous rays. It is natural then for the scientist to plan to use nuclear energy in those cases where he must have high temperatures, pressures, energy concentrations, and tc solar energy where gentle diffus tions are required.

For the ordinary purposes o dustry, solar energy needs coı trating, while nuclear energy r diffusing. At the moment, scier are getting on faster with the la but both will have great import in man's future.

• • •

What is this thing called ene which man can use for his dest tion or to set himself ever freer f control by his environment? recognize it in many forms, as l or heat or sound or electric po but all have in common the capa for doing work. They are merely ferent external manifestations three basic forms that exist in realm of protons, neutrons, and e trons: energy resulting from elec cal, magnetic, and gravitatic forces.

The flowing of a waterfall, heating of a house, and the hittin an enemy with a club utilize o minor routine residues of ener With the coming of the Indust Age men learned how to bring energy of the molecular world rectly to bear on mechanical pr lems, at the same time learning b ter how to harness the older resid forms of energy. With gunpowd and later gasoline, they were able release energy in much more conc trated form and in greater quanti In the early years of this century s

entists sensed the even more concentrated and vaster supply of energy in the nucleus of the atom, and in 1942 they learned how to release this energy directly.

Mastery of the nucleus will mark a much bigger step in man's ability to control his environment than any he has taken before The new "fire" of atoms presents to man an opportunity similar to that he received when he first drew back a burned finger from the fire of molecules, now raised in intensity to a hidden but transcendent power

When nuclear fission occurs only about one thousandth of the energy content of an atom is released, and scientists know how to set this energy free from only a few of the heavier kinds of natural atoms But with the processes of nuclear fusion, up to ten times as much of an atom's energy can be released

In one of its simplest forms, fusion involves the combination of two protons with two neutrons to form the nucleus of a helium atom The sun gets most of its energy in this way Though the sun is an excellent hydrogen fusion reactor, it is early yet to decide whether we can ever have on earth a small one so well controlled—one that will operate at a strong simmer instead of exploding in a millionth of a second, or that need not be kept a thousand miles away to be of any use If the speed, instead of merely the extent, of a thermonuclear reaction can ever be controlled, water may well furnish a super-fuel better than any of those of which men have dreamed

Inventors who have tried to develop pills that would make water burn were on the wrong track, for water is already ashes of hydrogen. When hydrogen is burned with oxygen their molecules combine to produce water, and release much chemical energy in the flame. The water remains after the energy is dissipated, and new energy must be used to "unburn" the water

But if protons are collected from the hydrogen in water and then assembled with neutrons to produce helium nuclei a vastly greater release of energy results—energy from nearer the base of the universal supply At present no one appears to know how to control this reaction beyond setting it off with an atomic bomb as a primer, thus raising nuclear temperatures to those needed to start a fusion reaction

If this process could be slowed down and controlled, the oceans would provide an inexhaustible reservoir of energy, and man would never need to worry about power again But he has much to learn before this can come about

Some day the physical hungers of all humanity may well be filled by further gentling of the energies of the atom bomb into those of food and warmth Then will it become apparent that energy from the atom, far from being the evil creation of a few clever but dangerous men, is a beneficent force of nature that has lying in wait since the begin time, until man could a awareness of its avai learn properly to use a

Indians Were Cannibals?

A State University of Iowa research team has found burned and crushed human bones—some in a cooking pot—in an early Indian settlement near Cherokee, Iowa

The bones confirm a theory that the Mill Creek Indians, probable ancestors of Sioux-speaking tribes, were cannibals.

The Indians, who are believed to have occupied this area from the 13th to the 17th century, did not eat humans as a source of food. The cannibalism was part of a ritual

R J Ruppe, director of the excavation, explains that the Indians ate captured enemy warriors They believed that in this way they acquired the strength of the enemy's men

The Iowa researchers' digging has uncovered five house floors, and weapons and farm tools. When the Indians left the area, they probably traveled by boat and had to leave most of their heavy weapons and tools

Food particles and bones show the Indians' diets included corn, beans, squash, clams, turtles, fish and deer, as well as human beings.

"Calming" Drug May Cause Depression, Report

An apparent paradox—that reserpine, a drug used for its tranquilizing effect on some mental patients and in certain cases of high blood pressure, is also liable to produce mental symptoms in the latter patients—is reported in *The Lancet*, British medical journal The drug is derived from the snake-like root of an Indian plant, Rauwolfia serpentina

The Lancet article is based in part, on findings of Prof F H Smirk and Dr E. G McQueen in New Zealand They reported good results in the treatment of hypertension (high blood pressure) with reserpine, except that disturbing mental symptoms appeared in some of the patients who received the drug

Symptoms usually take the form of more or less severe mental depression, unhappiness and withdrawal from the environment, according to the article Symptoms may clear promptly on withdrawal or may persist for some time.

In another report to *The Lancet*, Drs J. Gordon MacArthur and Bernard Isaacs describe treatment with reserpine of 20 female patients suffering from hypertension. Four of these patients suffered mental symptoms in the course of treatment In three of these it was necessary to withdraw reserpine, and two required psychiatric treatment. Symptoms exhibited, but not necessarily in each case, included depression, insomnia, agitation and anxiety. The remaining 16 patients showed no mental disturbance during treatment.

um, then we are right back where we started; the continents *are* floating due to the displacement of rock of depth.

Let's see how this picture of flotation jibes with known facts as determined by the most recent studies of earthquake waves Roughly, the average density of continental rocks is such that a column of continental rock, of uniform and large cross-section, might be expected to have 1⅞ths of mass above the sea floors around it The average depths of the Pacific and Atlantic Oceans are 2½ miles

Using the above figures, it is not too hard to arrive at a rough formula for the thickness of the continent If we let T=thickness of continental rock, and H=height above sea level, both of these expressed in miles, then $T=19+8H$

If you live in a continental area whose elevation is ½ mile above sea level, then the thickness of the continent beneath you is probably about 23 miles, plus or minus

At sea level, H=O, and the thickness there would be about 19 miles For an altitude of 1½ miles, T=31 miles.

The above figures agree amazingly well with continental rock thicknesses in several countries, as determined by very recent seismological studies However, it should be stressed that the formula given above disregards many known factors Therefore, rather than being an exact method, it should probably be considered more as a scientific toy—perhaps something like "Be the first one in your continental block to determine its thickness"

Here's an interesting thought, especially if you've traveled in transcontinental airplanes which we'll conservatively assume cruise at the respectable speed of 300 miles per hour: If you could head straight down through North America at this speed, it would take you just about five minutes to pass through the entire continental mass and leave the earth's crust!

Now we had better define this word "crust" which we have used. Actually the term is a misnomer and is a holdover from the days when scientists thought of the earth as being entirely molten except for its thin outer shell of "crust" which floated upon hot liquid Nowadays we know that this concept is false although we have seen that we can still speak of continents "floating," as it were, in rocks which are essentially rigid until a certain depth is reached

The "crust," therefore, comprises the continental and island masses of the earth and also includes the rock in and just below the ocean basins All of these "blocks" rest upon rock which is denser than both continental rock and the heavy rock immediately under our ocean basins

Do we have equal pressure along the lower limits of the eart' ' crust, that is at the bases of the v ous "blocks?" In general, ›

GORDON S FAY is a graduate geological engineer His home is in Reseda, Calif.

more than the same pressure would exist at the base of a large iceberg as exists at the base of a small iceberg. But there will be equal pressure beneath both at the level of the large iceberg's base

By analogy we can deduce that pressures in a stable region would be the same at a level corresponding approximately to the base of the region's largest "rockberg"—the continental mass having the deepest "roots" Using this method and checking by calculating actual pressures in various regions, it is now pretty well established that this depth, for several areas, is in the neighborhood of about 30 miles below sea level. Below this depth in these areas all components of the crust — be they mountain masses, plains regions, or filled deep-sea basins—are in equilibrium with each other.

What happens when forces tend to disturb this balance? A new mountainous area, for instance, may be vulgarly described as a "sucker" for erosion Why, then, do mountains persist through long periods of geologic time if their tops are being constantly worn away? Also assuming that its eroded particles find their way to sea level, we now have a lightened mountain mass and, we'll assume, an overloaded shore zone. It might seem impossible to restore balance unless nature now went into reverse much as a movie camera can snatch a swimmer out of water and arc him back onto the diving board.

But this is exactly where the big mechanism of isostasy comes in. To compensate for this overloading—and this is prevailing opinion—there must be a slow flow of rock at depth from beneath the overloaded area The rock, plastically flowing, goes under the roots of the mountains and raises the entire structure until balance is sufficiently restored Inasmuch as the surface of our earth is being continually altered, the process of isostatic adjustment must be continuous if we consider the earth as a whole. The process must also be a very slow one as it is a result of slowly acting external forces and is not itself a force

This may all seem like assigning magical reasoning powers to the flowing rock, enabling it to figure out where to go. Actually, it's merely the result of the earth trying to maintain itself in a reasonably spheroidal form.

Not enough is yet known about the rock zones—or even rocks themselves—to enable us to calculate with certainty the specific depths at which flow will take place. But it is known that subcrustal currents of some kind do operate in our earth. For instance the United States Coast and Geodetic Survey has a precise triangulation net straddling the mammoth San Andreas Fault which roughly parallels California's coast line. That is, the survey net *was* precise. The Survey now notes with considerable interest that the part of California to the west of the fault is moving off to the northwest at a rate of between one and two inches per year, and is thus throwing their survey net out of kilter.

An interesting aside here is that the proponents of the continental drift hypothesis have placed the initial break between South America and Africa as having taken place something over 100 million years ago This amounts to a "drift rate" for these two continents of between one and two inches per year, the same as for that half of California bent upon geographical secession

There are many evidences of isostatic adjustment Mountains stay at about the same height for measurable periods of time in spite of erosion, and some even seem to be growing in height In the Great Lakes region, rocks once depressed by the mammoth ice sheets are now springing back into position due to adjustment processes taking place far beneath the surface. Some geologists calculate that, due to this isostatic uplift, the drainage of some of the Great Lakes will be thrown into the Mississippi River system in less than 2,000 years.

It is known that the continents have never been deep-sea basins, nor have the deep-sea basins ever been continents We assume that this condition will be generally permanent because of isostatic adjustment in the earth's crust On the workaday side, it is now routine for geologists, geophysicists, and the U S Coast and Geodetic Survey to compensate for the effects of isostatic adjustment when making pertinent calculations

All in all, it appears that isostasy, the world's greatest balancing act—headlines or not—is here to stay

Brightest Star Is Just a Baby

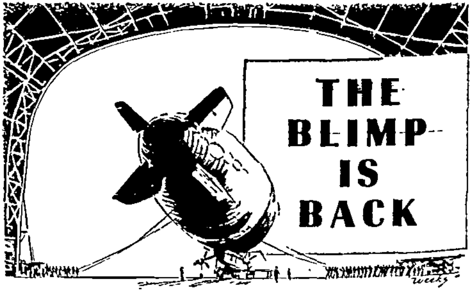
California scientists have shown that Sirius brightest of all stars as seen from earth is somewhat less than 100 million years old which is much younger than the earth Since it was formed much later than the creation of the universe around 5 billion years ago, the results suggest that stars are being born all the time

The researchers are Drs Louis Henyey and Karl-Heinz Boehm and two physicists Dr Robert Le Levier and Richard Levee both of the Livermore site of the Radiation Laboratory, operated by the University of California for the Atomic Energy Commission.

According to the new case history of Sirius it apparently was formed from a primordial cloud of dust and gas Soon after its formation Sirius was only half as hot about 150 times bigger in volume and yellowish instead of white

It was radiating energy at a tremendous rate contracting and heating up Soon the temperature rose enough to support thermonuclear reactions, in which hydrogen atoms fuse into helium atoms

Sirius apparently has about 5 [illegible] lion years to go to deplete the at its core At the end of core will have expanded one-half times over its [illegible] it will turn yellow again.



by Hanson W. Baldwin

Condensed from The New York Times Magazine

THE WHALES of the air are back, dipping and rocking in the sky waves, cruising low above the oceans off our coasts. There has been a rebirth of the Navy's blimp fleet. Blimps are now a proven part of our antisubmarine warfare organization, and are assuming new importance as radar sentinels and electronic control centers in our continental defense system.

Almost 50 helium-filled airships are now in commission in the United States Navy, and another 20 to 30 are on order. And design studies for a blimp twice as large as any in existence have been started.

The "bloopy bags" were once in bad repute. Just prior to World War II the Navy had only six airships capable of service at sea. Lighter-than-air was a term often used derisively. "He's helium-brained" used to be a slur of the day, and the "blimp jockeys" were men apart—in the Navy, but not of it.

Airships had suffered because of the tremendous progress made in range and cargo-carrying capacity by the heavier-than-air plane, and because the loss in accidents of the Navy's giant rigid airships — the *Shenandoah*, the *Akron* and the *Macon* — had given the airship a public and professional black eye. The dramatic destruction by fire in 1937 of the German trans-Atlantic Zeppelin, *Hindenburg* — a rigid-framed giant airship with 7,063,000 cubic feet of inflammable hydrogen

in her huge gas cells — seemed to spell the end of airships

But the war proved differently. The blimp, because of its long range, its hovering ability and its stability as a platform for electronic instruments, became a good sub-hunter The Navy ended the war with the proud boast that blimps had escorted 89,000 ships without losing one to enemy submarines

A major reason for the Navy's progress with airships is that the United States happens to possess a virtual monopoly of helium Britain, Germany and even Russia produce helium — if at all — only in small amounts.

Helium is a peculiar gas. It is expensive and it does not have as much "lift" as hydrogen You can fill the gas cell of a 35,000-cubic-foot free balloon with ordinary cooking gas for about $40, with hydrogen for about $300, helium would cost many times that. But it compensates for its expense.

A modern blimp costs about $4 to $5 million over-all — more than a fighter plane, about the same as a big bomber But most of the "lift" is supplied by helium—not by power The blimp uses very little gasoline, and the average operating costs per hour of an airship are something like $9 to $10 as compared to five times that amount for heavier-than air patrol planes

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Hanson W Baldwin, U S Naval Academy graduate, is the *New York Times* military editor

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Helium also provides a "built-in fire extinguisher " It is a good smothering agent. and gas from the bag can be valved to the engines and gasoline tanks in case of fire It has a few perils. it is odorless and tasteless, inert and dangerous to life. But riggers and crew men who work on rips in the fabric or come into near contact with helium leaks wear special helium masks, and life-lines are roped around their waists.

It is this gas, pressing gently against a rubberized fabric skin that gives the blimp its fat, ungainly, whale-like form The name "blimp" is of British derivation and dates back to World War I The British tagged one class of their airships "Limps" to distinguish them from rigid-metallic-framed airships, such as the German Zeppelins Their first category of "Limps" was described as "A-Limps," the second as "B-Limps" — and the name blimp was born

The airship envelope is limp, there is no structural metal to hold it in place except in the rudders and elevators The outward pressure of the helium against the rubberized fabric keeps the blimp in shape Only around the bow of the huge bag are stiffeners used Here, wooden battens—like battens used in sails—are sewn into the fabric, so that the bow will not be distorted as the blimp noses into a wind at 50 knots

A blimp is a hybrid beast The name airship is well taken, for she's one part surface ship, one part s marine, one part balloon and part plane She wallows and

the airways as a surface ship does in the seaways. There are none of the violent jerks, the bouncing drops and upsurges the passenger feels in a plane. But you can get seasick—and the word is seasick, not airsick—in a blimp in rough weather, for this ship of the air pitches like a freighter.

Like a submarine, a blimp controls its progress through the ocean (of air) not only by the speed and power of its engines and the angle of its rudders and elevators (or in some models, "ruddervators"), but also by increasing or decreasing its weight and by altering its trim.

The "lift" of a blimp can, of course, be decreased by valving helium; but helium is precious stuff and valving is avoided when possible. The diminishing weight of gasoline as it is used by the engines can be compensated for at sea by taking on water with a canvas water bag suspended by a cable (the blimp is a low-flying, slow-speed fellow) or the blimp can refuel, either by hose or drum, from aircraft carriers or other ships.

The blimp also uses air to trim herself, fore and aft Her trim tanks are called ballonets; there is usually one forward, one aft, and in big blimps there is also a central midship ballonet. The ballonet chambers are about a quarter as big as the gas bag; air is scooped into them as needed, and to trim the ship fore and aft the air can be valved.

By increasing or decreasing the air in the ballonets the blimp crew can usually avoid valving helium. Helium expands or contracts, of course, with temperature and altitude changes; for every 1,000 feet of altitude there is a 3-percent change in volumetric capacity. The ballonets — squeezed empty or full of air — provide flexible expansion and contraction chambers as the helium expands or contracts.

Even so, the blimp is still a low-altitude ship. The records do not seem to show what the blimp altitude record is; some veterans have been to 12,000 feet, even though the so-called absolute ceiling is much lower. Fortunately, a blimp's job is usually near the water.

The blimp, despite the power of its two engines, has many of the attributes of the free balloon. There are no seat belts (except for the pilots, who wear them only in rough weather) and no parachutes. The

If both engines go, the blimp can be handled, though awkwardly, like a free balloon, dropping water or sandbags or even its gas tanks to rise, and valving helium to settle.

But blimps have taken over in the past few years many of the accessories and methods and techniques of heavier-than-air craft. It used to take two men to handle the two wheels—the pilot on the elevators the co-pilot on the rudders Now blimps have conventional aircraft controls and one man handles the ship There are automatic pilots for long flights.

Blimps are powered by two gasoline engines mounted on outriggers

on either side of the control car, or, in the newest type, the engines are mounted in engine cabs in the control car where they are easily accessible in flight. There are full-feathering controllable-pitch reversible propellers, as in planes, and retractable landing gear under the control car

Contrary to popular impression, a blimp doesn t just rise: it takes off under its own power Usually the crew tries to have a blimp about 2,000 to 4,000 pounds heavy on takeoff; on landings after it has used up some of its gasoline it is about 600 to 1,200 pounds heavy This means it takes off and lands with a run like an airplane and depends partially upon the power of its engines to climb up into the atmosphere

> • The reason we are on a more imaginative level is not because we have finer imaginations, but because we have better instruments. In science the most important thing that has happened is the advance in instrumental design
> —Alfred North Whitehead

It is a unique experience to take off and land in a blimp for the first time. You walk out on the landing mat, under the belly of the blimp, and climb up a ladder into the aluminum and balsa-wood control car This is one of the Navy's newest airships—designated, ZPG-2 She's almost as long as a destroyer and she carries a crew of 15 or 16, half of them officer-pilots.

The great bag, with its 1,000,000 cubic feet of helium, shadows you as you hurry forward to the pilot's cockpit to watch the takeoff. The blimp's nose is mated tightly to a coupling in a mobile mooring mast; a tractor hauls the mast, with the blimp bobbing behind it, to takeoff position

On the ground you see the ground handling party of from 30 to 70 men, depending on the wind conditions, wearing red and green and yellow aprons — something like the functional color scheme of a flight-deck crew aboard an aircraft carrier

Takeoff is simple. The mooring mast is uncoupled and the tractor hauls it away The pilot revs his engines, and signals the ground handling officer The blimp gathers way, trundling along on her tricycle landing gear, the ground crew runs to the side and quickly releases the airship's bow and stern handling lines

She takes about 800 or 900 feet of runway before the rigger in the stern reports over the intercom, "Tail clear " You're in slow-motion flight now, cruising at about 40 knots, or slightly more than 40 miles per hour. Only the pilot is working hard. He moves the control column in great sweeping exaggerated motions — motions which would put a plane into a loop or dive, but which are necessary on blimp takeoffs and landings because of the slow speed and small control surfaces

After a while the auto-pilot is connected, and the blimp flies herself, out over the sea, bowing and dipping along at a speed she can m... without strain for a couple of The crew settles down to its tional stations—and you through the control c tain, skipper of the

This one is spacious, it is built in two "decks," the upper one for living and berthing, the lower level for operations and working space The car it attached to the gas bag by steel cables spliced to curtains of fabric, stitched and glued to the upper inside of the bag The curtains distribute the weight evenly around the envelope.

On the upper level, above the pilot's cockpit, are nine comfortable bunks in tiers, aft are washrooms and lockers, an electric kitchen with plenty of food, and then a wardroom with tables and shaded lights.

Down the ladder on the lower level, you move aft from the big cockpit into the "CIC" (Combat Information Center). Here are the combat "guts" of the blimp—the instruments that make it a valuable weapon of defense.

Here most of the crew is stationed in flight—bending over radar screens, manning radio sets. In a maze of instruments are radar, for use against snorkeling or surfaced submarines; sonar and sonar buoys, to be dropped from the blimp; "MAD" — Magnetic Airborne Detector — for detecting submerged submarines; radar for use against aircraft; radio direction finders; and radio and control and navigation instruments, for plotting positions, keeping in touch with other members of the team and for controlling friendly planes

"Blimps have many functions," the squadron commander explains "They can spot mines and can even be used for minesweeping. Their natural enemy is the submarine. They can fly ahead of a convoy or ahead of the fleet, and can pick up surfaced or snorkeling submarines with their radar, and can vector friendly planes to the kill. . . ."

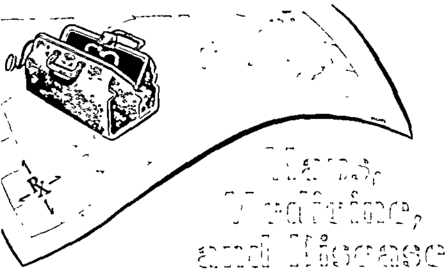
"We have killing weapons, too," the skipper explains: "depth charges, and homing-type weapons. And the newest-type blimp—the ZPG-2W—has airborn early-warning detection equipment.

"Our chief advantage is we have endurance, and we don't mind zero-zero visibility and low overcasts. Of course, any wind above 35 knots hampers us — our maxium speed is about 70 knots—and it would take us too long to get to our patrol area But once we are there, we can cruise for days on end; a ZPG-2 has cruised for more than 200 hours—8 days, 3,000 miles. It takes a pretty good submarine to get away from that. We can cruise as slowly as the sub—or four times as fast—and we can hover, like a helicopter."

"And we've got economy," the captain continues. "Helium does it. we need only about 1 horsepower per 80 pounds of load—about 8 times better than a heavier-than-air plane

"Our morale's up. We've got a job to do, and we're doing it. . . . And it's a nice way to go to sea—in the bags "

THE FIRST airplane engine developed only 16 horsepower; a modern jet engine develops the equivalent of over 10 000



Maps, Medicine, and Disease

by Georg Mann

W 'HY does one disease hop-skip-and-jump across a country, nother stick close to rivers or forsts? What role is played by climate, icluding temperature and rainfall? Vhy are diseases of the heart and lood vessels more frequent in temerate climates while tuberculosis, mallpox, and typhoid fever thrive lmost anywhere?

The answer to these and similar uestions haven't been found, yet. Ierely being able to ask them marks major breakthrough for the union f two old sciences against disease)ne is medicine, geography is the ther. Pinpoint the spread of a disase on a map, and new relationships ppear, and new and provocative uestions demand answers

Paradoxes emerge, requiring furher study In certain notably unealthy villages in Ecuador's provnce of Loja, where malaria and typhoid flourish, heart disease is almost unknown Yet heart disease crops up in what appears to be an essentially similar community only 40 miles away That answer isn't known

But the answer to why trichinosis is more prevalent on both coasts of the United States than in the Midwestern corn-hog region is simple. In the latter area, hog raising is conducted on an industrial basis, with corn providing the raw material for the pork On the coasts, hog raising is often a sideline, and the hogs are frequently fed on garbage, which spreads the worms that cause the disease.

Sometimes, unless all the factors are known, the answers can also be wrong. Arizona had a traditionall high death rate from tubercul which would make the state s healthy—until it is remember

many tuberculosis victims seek the *Arizona climate to benefit their* disease.

The beginnings of medical geography are hard to trace. As early as the 18th century, physicians were setting down meticulous records of diseases as they differed in areas as wide apart as Jamaica and Plymouth, England. In the 19th century, as the white man moved into the tropics and met a host of new diseases, medical geography received a new impetus. Another impetus came from World Wars I and II, where farflung combat lines posed new headaches for military physicians.

During World War II, the German Wehrmacht, gazing greedily at its neighbors, was aided by accurate maps of diseases, with special emphasis on those of the Mediterranean area and the trans-Caspian areas of Russia

At the war's end, the U. S Navy, working with a group of German experts, began publishing an atlas of disease in major areas of the world. The American Geographical Society of New York also started publishing a *series of maps pinpointing the* location of world diseases.

The task isn't easy. Statistics are often hard to find. The Moslems seem to be convinced that there is little enough point in counting people, let alone the incidence of disease. Man's numbers, they believe, need be known only to Allah. Statistics from many areas of the world are only roughly accurate.

Also, the problems of mapping infectious disease differ somewhat from mapping chronic ones. Involved in mapping both can be such factors as population density, temperature, rainfall, latitude, altitude, distance from the sea, and chemicals present in the soil.

For infectious diseases, there is the problem of mapping the conditions where the organism that causes the disease can flourish (the yellow-fever virus needs certain temperatures to multiply), where the insects, mites, or similar carriers of the organisms can flourish, and finally those areas where man suffers from the disease. Thus it may take several maps to give sufficient information about a single disease. In the case of viruses alone, temperature, humidity, and even the earth's electromagnetic field and the abundance of ultraviolet radiations may require mapping.

Nutritional diseases are simpler to map, because it is usually easy to discover those areas where lack of an essential food item—or even the lack of enough food in general—will cause disease Mapping can show not only where such diseases as beriberi and pellagra are found, but also the iodine-lacking goiterous areas of the [illegible] States

graphical factors may be far more difficult, yet far more rewarding

Maps point up the direct relationship between temperature and the occurrence of disease. In India, outbreaks of sandfly fever are delayed

when the weather is cool, stepped up when the weather is hot.

Typhoid fever shows a marked seasonal pattern, reaching a peak in Canada and Japan in September, in Uruguay in March and in Australia during January. Polio also has seasonal trends in this country, increasing during the summer and ending in cold weather

And cholera is affected by the weather, although the specific effects may be opposite in different localities In some places in India, cholera outbreaks occur when the rains fail and a drought sets in In other Indian areas, cholera becomes a greater danger when the humidity is high

• The story of any science lies as much in the story of the men who wrote the important books as in the story of the men who made the great discoveries
—Harold A Calahan

Chagas disease in South America seems to be linked to another geographical factor It occurs only where the armadillo is found The organism that causes the disease lives harmlessly in the armadillo, is transmitted to man by a bloodsucking insect

The geography of a specific disease such as polio raises interesting questions The evidence shows that European outbreaks are heaviest in the Scandinavian countries, with epidemics fluctuating in intensity from season to season European polio tends to focus in cities and travels about 30 to 60 miles in a single year Yet the pattern is so spotty that it almost screams a "Why?" at the medical scientists

Some areas of western Germany have been hit almost as hard as the Scandinavian countries, and much worse than either France or Spain Iceland has been the scene of major epidemics

In the United States, the disease is much more severe in the northern states As in Europe, it tends to concentrate in the highly industrialized areas where sanitation practices are most advanced.

In such relatively backward areas as India and China, polio lags far behind other diseases in severity, despite the much lower standards of sanitation.

There seems little question that the disease has increased in vindictiveness since the start of this century, or that the age group most severely attacked is gradually moving up In Scandinavia, children between 5 and 15—or even older—are the favorite victims, while in Brazil and Chile, the disease is most severe in the less-than-1-year-old group

Take another disease infectious hepatitis—inflammation of the liver. Two patterns seem to exist in Europe In the West, the disease is ordinarily rare, punctuated by sudden outbreaks among adults in such countries as England and Western Germany, where the standards of living are relatively high In Eastern Europe where less attention has been paid to sanitation hepatitis is an endemic constantly recurring c dren's disease

Yellow fever is rampan Africa's west coast The

that carries the disease is a close associate of man, has fairly specific environmental needs that permit it to flourish in jungles. But why is the disease not common in Asia, where it has almost the same opportunities for flourishing as in Africa or Central and South America?

And what is the reason that dengue fever and yellow fever seldom exist together in the same place? Dengue, a much milder fever, is carried by the same mosquito that carries yellow fever.

Leprosy—Hansen's disease—has been mapped to show a relationship to warm, humid climates, and dense populations However, it does exist in northern Europe, and cases have also turned up in the Balkans and Spain In Haiti, leprosy has been mapped in relationship to altitude, temperature, and rainfall.

Tularemia — rabbit fever — has been shown by the geographers to be more prevalent in Europe than in the United States. In the U. S., rabbits are the main carriers, through the ticks and flies that impartially bite both rabbits and man.

In Europe, water rats and mice, as well as rabbits, carry the disease. In Russia, tularemia follows the geographical line that separates the forests from the steppes. The forests have relatively little of the disease, because they offer a less favorable home for the rodent carriers. The dry climate of the steppes also aids the spread of tularemia.

Tick-borne fevers have been thoroughly mapped in the United States For example, Rocky Mountain spotted fever has moved generally over the country. Twenty years ago, the disease was found to vary widely in its impact. In Montana, 60 to 90 percent of persons infected with the disease died. In neighboring Idaho, where the disease was mild and confined largely to shepherds, only two or three out of every hundred victims perished.

Tropical diseases have been particularly well mapped. Most people associate malaria, leprosy, yellow fever, and a host of obscure and fatal fevers with the tropics. Actually, tuberculosis is a leading killer. Goiter turns up in the heart of Africa. Pneumonia, almost obliterated as a killer in the United States, still rages in such tropical areas as Ceylon, Nigeria, and Tanganyika Nephritis (inflammation of the kidneys) is also common in the tropics.

Another problem for the medic[al] geographers is why "pockets" of in[fection] exist in certain areas. Born[holm] disease—a virus disease whic[h] has a permanent center of infectio[n] around Bamle, South Norway—is [a] classic example. In the U. S., ther[e] seems to be a pocket of streptococcu[s] infection in Idaho.

A few years ago, Dr. James M Dunning tried mapping the pattern of tooth decay in the United States His findings indicate generally that the farther north, the farther from the sea coast, the greater the amount of tooth decay. Moving up from Texas through the Midwest, the amount of tooth decay increases fairly steadily until the Dakotas are reached.

Why does this happen? Dunning offers a few tentative suggestions It may be the colder the climate the more carbohydrates people eat—and such starchy and sugary foods are believed to encourage tooth decay Furthermore, wells closer to the coast tend to be deeper, with a resulting higher fluorine content in the water.

Cancer provides a fertile field for the maps of the medical geographer Cancer of the breast in males occurs in Africa in higher rate than anywhere else in the world—and this in spite of the fact that the natives are relatively short-lived, and theoretically less likely to reach the ages where cancer becomes a major problem Among certain African tribes, such as the Bantu, cancer of the liver tends to be extremely common

In the United States, Dr Harold F. Dorn chief of the biometrics branch of the National Institutes of Health has reported, "The incidence rate for nearly all forms of cancer is nearly 50 percent higher for white persons living in the South than for those living in the North. This is largely due to the existence of more cancer of the skin and mouth in the South"

Studies about other types of cancer reveal that in Denmark cancer of the esophagus is commoner among hotel and restaurant workers and commercial travelers than among workers in other types of jobs Stomach cancer in Denmark is more prevalent in rural than in urban areas. In England, the reverse is true Chinese laborers in Sumatra suffer far more from both stomach cancer and stomach ulcers than do natives working beside them in the rice fields

Like so much of medical geography, these facts pose more questions than they answer The questions, however, may lead to new approaches to cancer and other diseases As Dr Alexander Symeonidis has remarked about cancer "Before we can find the why, we must find the where" That idea typifies the approach of the medical geographer

Glass Stronger than Steel?

Bridges and buildings of glass are just two of the scientists' dreams for tomorrow, hinging on the untapped potentials of glass which they hope to realize Thus far the glass industry has been able to attain only 1 percent of the material's theoretical strength according to Oscar G Burch, vice-president in charge of engineering and research at the Owens-Illinois Glass Co

But, "when we have achieved 10 percent" he said "we are firmly convinced that glass will come into its own as a structural material stronger than steel yet vastly lighter"

Other glass developments envisioned by the scientists are

- Glass auto bodies
- Trains rocketing across country in glass tubes propelled at airplane speeds by compressed air
- Glass spaceships
- Communities in certain areas—su as the Arctic—enclosed with g! provide a completely controlled phere

a science milestone

[illegible] Classifica of the Elements

by Evarts Erickson

ONE DAY in January, 1871, a plain-speaking Russian gave the world an unforgettable lesson in chemistry.

The Russian was Dmitri Ivanovich Mendeleev,* professor at the University of St. Petersburg. The chemistry lesson he gave was in the form of a prediction which many considered mere sensationalism Guided by his famous classification of the elements, the periodic table, Mendeleev predicted the discovery of three new elements — which he named eka-silicon, eka-boron, and eka-aluminum.

Not only did he indicate where these elements might be found, he also described their chemical properties in minute mathematical detail. No scientist had ever made such a prediction before.

Five years later, a Parisian chemist, flaming a rare zinc from the Pyrenees, chanced on eka-aluminum. Then, in 1879, a Dane discovered eka-boron And in 1886, a German isolated eka-silicon. They named these new elements gallium, scandium, and germanium respectively.

As Mendeleev's fame grew, some nations, jealous for the honor of having been the origin of the la which he had based his great p tions, claimed the discovery for own scientists.

But Mendeleev was the only s tist who dared to foretell the p erties of the undiscovered elem to alter accepted atomic weights in general, to regard the periodi from the beginning as a new, str established law of nature.

Because of these facts, he i garded as the great systematiz chemical knowledge.

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Dmitri Ivanovich Mendeleev born in Tobolsk, in Siberia, on F ruary 7, 1834, the youngest in a f ily of 17 children. His father, a rector in the local college, died w Dmitri was 13. Two years later, window took the boy to Mosc hoping he could win a scholarsh Unsuccessful in Moscow, Dmitri a his mother journeyed on to Petersburg. There Mendeleev e tered the Pedagogical Institu where he trained to be a chemis instructor.

His part-Tartar mother, w taught herself Latin at the age of

*Also spelled Mendeléyev, Mendeléeff, Mendeljeff, and Mendelyeev

so she could coach him (Mendeleev hated Latin) on his scholarship exams, died while he was still a student in St. Petersburg. In his *Principles of Chemistry,* Mendeleev afterwards reported her last words to him They were:

"Refrain from illusions. Insist on work Search for divine and scientific truth "

That was a fine legacy to leave anyone, and Mendeleev amply lived up to it.

At the Institute, where he won top honors, he nearly crushed himself with overwork. When he graduated doctors diagnosed tuberculosis, gave him six months to live. But Mendeleev made a miraculous recovery. After a short stay in the Crimea, he returned to St. Petersburg to write his master's thesis. It was one of the first of the more than 250 scientific papers he would eventually publish.

In 1859 the Russian government recognized his brilliance by sending him abroad to study. Mendeleev spent two years in the laboratories of Paris and Heidelberg Back home again, he began an intense program of activity — urging more schools, more teachers; equal educational opportunities for women; protection for Russia's infant chemical industry, exploitation of Russia's mineral resources; the development of scientific farming—that was to last until the day he died.

Within a few years he married, wrote in two months a 500-page textbook on organic chemistry which won the celebrated Domidov Prize, and gained his doctorate with the thesis *On the Combination of Alcohol with Water.* Appointed a full professor at the University of St Petersburg before he was 33, Mendeleev soon began the work which would win him world-reknown: the discovery of a plan of unity among the elements.

At the time Mendeleev began his great search, 63 chemical elements were known to man. Two of these, caesium and rubidium, had been isolated during Mendeleev's sojourn in Heidelberg. It seemed probable that others existed in nature. But as regards the elements themselves, chemists recognized that all was chaos and confusion.

The amount of knowledge that had been amassed on the elements was enormous, but it existed as a collection of apparently unrelated facts. Basically, the elements were divided into metals and non-metals, or base-formers and acid-formers. But — studied in certain compounds — arsenic and other minerals had non-metallic characteristics. Also, some elements were both base-formers and acid-formers.

From hydrogen, with an atomic weight of 1, to uranium, with an atomic weight of 238, each element has its own physical characteristics and chemical properties Thus chlorine is a green poisonous gas; gold a yellow ductile metal; boron a brown powder. Most metals are

with explosive rapi argon never

combines. And so on, *ad infinitum.*

Was there a unity in this diversity? Chemists doubted it. Nonetheless, some simple relationships had been discovered.

Between 1817-1829, a German professor of chemistry named Johann Wolfgang Dobereiner pointed out that some elements seemed to form groups of threes, which he called "triads." In these triads, atomic weight and the numerical expression of certain other physical properties were in arithmetical progression. Later, these triads were expanded to include elements whose similar characteristics obviously placed them in the same groups.

Throughout the early and mid-19th century, a few pioneering chemists continued to seek for some common formula or pattern of interrelationship that would harmonize the disharmonious elements A Frenchman, A E. B. de Chancourtois, proposed an especially ingenious and complicated system in which the elements were plotted on a helical curve.

Other schemes were put forward by the Germans Strecher and Meyer, by T. A. R. Newlands and William Odling in England, and by T. P. Cooke in the United States. Cooke, a Harvard professor, published in 1854, the first scientific attempt to classify the elements by their atomic weights.

Newlands made a particularly brilliant stab in the dark. At a meeting of the English Chemical Society in 1866, the young Englishman demonstrated a table in which he had arranged some of the elements in order of their increasing atomic weights The eighth element, sodium, now had chemical properties similar to lithium, the first element in his series (he ignored hydrogen). This similarity also held true in more or less loose fashion within his other vertical groups.

Newlands compared his chart to a piano keyboard, and called this tendency to periodic repetition the "law of octaves " Unfortunately, his audience was less than polite. One listener even asked him whether he'd though of arranging them by their initial letters. Newlands timidly dropped the matter.

Mendeleev, who did not know of Newlands, was also searching for a plan of unity In order to facilitate his task, he noted all the information that had been obtained for each element on a separate card. He then tacked these cards to the wall of his office. As he studied them, he tried them out in various arrangements, seeking the common denominator.

In all parts of the world, chemists were working with the elements Mendeleev tracked these chemists down, corresponded with them, correlated their bits and tags of knowledge, checked them in his own laboratory, and added these fragments to his encyclopedic whole. He also performed countless original experiments, concerning himself particularly with chemical properties such as base- or acid-formation and valence.

"I soon became aware," Mendeleev said afterwards, "that if I

1834 DMITRI IVANOVICH MENDELEEV 1907

placed the elements according to their atomic weights, starting with the lightest, a kind of periodicity became apparent."

The Russian chemist formulated this observation as follows:

The chemical properties of the elements are a periodic function of their atomic weights.

To show the operation of this law of nature, Mendeleev devised a table in which (as in Newlands') there were seven vertical groups or families of elements with similar chemical characteristics. When atomic weights seemed obviously inaccurate he boldly placed elements in the columns where he thought they belonged. He also saw the necessity for sub-groups within the families, and recognized for the first time that the outstanding periodic property of the elements is valency.

Valency is a chemical term for the way in which one element unites with another. Thus, in one of Mendeleev's groups, two atoms of any element would combine with one atom of oxygen. In another group, one atom of any element would combine with three atoms of oxygen, and so on. In this so-called periodic table, the elements fell into seven families with valency from one to seven respectively.

Formerly, chemists had had to learn a different chemistry for each element — as many chemistries as there were elements. Now if they knew one element in a group, they could foretell the valency (and generally speaking, other chemical and physical properties) of all the other elements in that group.

Moreover, the table could be used to correct atomic weight, and to predict the existence and properties of undiscovered elements. To chemists, the periodic table was "a card catalog, filing system, reference chart, and comparison table all rolled one."

In March, 1869, Mendeleev nounced his discovery to the

Chemical Society; soon his paper was printed in the Society's journal and forwarded to the foreign chemical societies. The response from abroad was disappointing. True, a vast generalization of the kind Mendeleev now proposed had been made, in the field of evolution, by Darwin, and earlier, in astronomical physics, by Newton; but that such should be possible for chemistry, and should originate in backward Russia, the product of a booted, hirsute Siberian, was a little too much for Western chemists to accept.

Mendeleev decided on a bold move. In his table were several blank spaces. One of these occurred under the element boron, between calcium and titanium. Another occurred under aluminium, and a third under silicon.

In January of 1871, therefore, Mendeleev, published his great prediction. He predicted that three new elements would be discovered. To these he gave the name of the elements which they would most closely resemble, with the prefix *eka*. Eka came from the Sanscrit. It meant "like." He described in detail the properties which these new elements would have. In addition, he added a few more to the list of atomic weights which he had already corrected.

In 1875, while he was waiting for confirmation of his prediction, a wave of spiritualism swept over Russia, even affecting some of the faculty and students in the University. Mendeleev offered to examine its manifestations (table-raising, weird voices, etc.) under controlled laboratory conditions, and concluded there was not much to it. Said he to his students: "The most all-penetrating spirit, before which will open the possibility of tilting not tables, but planets, is the spirit of free human inquiry. Believe only in that"

Within 15 years the three elements had been discovered. In all three cases, Mendeleev's description of their principal characteristics was strikingly confirmed. Even to scientists, the correspondence was amazing, while to the public at large, Mendeleev took on the aura of a medieval alchemist The leading scientific societies and universities of Europe and America showered him with their honors.

It is also interesting to note that the old prophet was fascinated by the reported discovery of radioactivity in uranium. He urged young research chemists, just starting out on their careers, to "occupy themselves with uranium."

Even in Russia, Mendeleev's beard was notable. Mendeleev used to have it clipped once a year. He went to his country estate for the operation. which was performed by an ex-sheep shearer. When the Czar demanded an audience with him, after the last of the predicted elements had been discovered, he made a single request: that Mendeleev first see the barber. Mendeleev refused, but the Czar received him anyway.

With the discovery of the inert gases in the 1890's, a so-called Zero Group was added to the periodic table. But Mendeleev's brainchild still had to undergo some alterations.

For instance the rare earths, a group of 15 closely-related metals, did not fit into the table readily. It also stressed some uncommon valencies But compared to the greatness of the law which Mendeleev had unfolded, these were minor failings

The solution was found when chemists began to have a better knowledge of the electronic structure of the atom. In 1912, H G J Moseley determined that the fundamental property of an element is not its atomic weight but its atomic number: the number of protons in the nucleus. The law was now amended to read: The properties of the elements are a periodic function of their atomic number This finally cleared up the discrepancies

Mendeleev, who continued to work on revising the periodic table throughout his lifetime, resigned from the University in 1890 and three years later became head of the Russian Bureau of Weights and Standards. Apart from his formulation of the periodic law, he performed notable research in the fields of critical temperatures, specific volumes, the thermal expansion of liquids, the elasticity of gases, and the nature of solutions He was also instrumental in opening up to exploitation the vast coal and oil deposits of the Donetz and Caspian basins, thus inaugurating the industrial revolution in Russia.

In middle age, the shy, gruff Siberian chemist fell in love with a young Cossack maiden, was divorced from his separated first wife, and proceeded to thaw like an elderly Mr Chips. His second union was blessed with four children who formed the principal joy of his autumn years

When a total solar eclipse occurred over Russia in 1887, Mendeleev was chosen by fellow-scientists to go aloft in a government balloon, make observations When the moment came for the ascension, the balloon was overloaded, so Mendeleev pushed the army aeronaut out of the basket and with no previous instructions went aloft by himself He rose to 11,000 feet, carefully made his observations, and landed some two hours later and 150 miles distant from his point of departure

A few weeks before he died, Mendeleev had expressed a desire to accompany a proposed expedition by balloon to the North Pole He was then 72 At the time of his death, his wife was reading to him from the Jules Verne romance, *To the North Pole*

On January 20, 1907 Mendeleev died of pneumonia in St Petersburg The Czar gave him a glittering state funeral But the real tribute came from the thousands of grieving Russians who followed his coffin to the cemetery In the van of the procession, two students carried a banner appropriately inscribed with the periodic table of the elements

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HAWKS apparently have the sharpest vision of all creatures, says the Better Vision Institute—about eight times as sharp as man's.

Inventions Patents Processes

Library of Noise

A library of noise is being assembled in a new sound laboratory recently completed by the General Electric Co. at Fort Wayne, Ind.

Recordings of the slightest murmur of electrical transformers and motors will make the "noise library" one of the most unique such collections in existence. The recordings will be used to compare various noises from different types of equipment, so that noise sources can be reduced or eliminated.

In making noise analyses, equipment to be tested is sealed in a sound-proof testing room, with sensitive testing instruments located nearby. Not even the engineers making the test are allowed in the room during the operation, since the natural noises of the human body, and the reflections from it, are sufficient to distort test results.

With the equipment under test operated by remote control, the listening instruments pick up the slightest sound, recording it outside the room on elaborate charts and graphs, which result in a sound spectrum. This is in sound analysis what a color chart is in art.

Because any noise is a combination of frequencies, a complete sound spectrum shows exactly how much noise is being produced at every frequency. A sneeze, for instance, depending on who sneezes, might contain noises at several dozen frequencies, some of which are not audible to the human ear. Average human beings can detect noises at frequencies between 20 and 18,000 cycles per second.

The sound-testing chamber, literally a 500,000-pound room within a room, floats on steel springs and rubber shock absorbers, to help prevent transmission of practically any ground vibration such as is caused by a passing train. The walls of the inner room are of 8-inch concrete, lined with 3 inches of mineral fiber acoustic batting. Over this layer is another 3 inches of the same material in the form of a giant washboard whose ridges are 3 feet deep, covering all 6 inner surfaces of the room.

A steel ramp extends into the exact center of the room where the engineers put equipment to be tested. Microphones and testing instruments hang above, and are connected to recording equipment outside the room. In an actual test, the huge doors to the room also covered with sound-absorbent mineral fiber, are locked into place.

The resulting quiet is estimated to be 50 times quieter than the average suburban living room at the dead of night. Though they haven't tried it yet, G-E engineers guess that a mosquito in the room would probably sound like a chain saw slicing a hardwood log.

Lighter Glass Jars, Glass Solder Produced

Two new developments in glass research, a lighter-weight glass container and a low-temperature glass solder, have been announced at the Owens-I[illegible] Center, Toledo, Ohio [illegible] similar containers, is made by a new

method of controlling the transfer of heat from the glass as it leaves the furnace This process cools the jars rapidly and induces controlled stresses making the glass many times stronger than ordinary annealed glass

In announcing the development of a glass solder Carl R. Megowen, president of Owens-Illinois, stated that color television broadcasting may be expedited by its use It is now being used experimentally on color television tubes It is an all-glass solder which has the advantage of giving a permanent seal, but can be opened and resealed by the application of heat. This enables the working parts of the bulb to be installed or removed for repair without destroying the bulb

Transistorized Auto Radio

An experimental transistorized automobile radio that operates directly from a 6-volt car battery and requires only about 1/20th of the power used by a conventional car radio was described recently by scientists of the Radio Corp of America

The new radio employs 9 transistors in place of electron tubes Emphasizing its low power consumption, RCA scientists pointed out that more than half the small amount of current required by the radio is used to light the 2 small pilot lights that illuminate its dial A radio of this type, they said would create so little drain on a car battery that it could eliminate many cases of battery failure that now occur when a driver forgets to turn off the radio when he parks his car

The radio has been tested at Princeton with a 6-volt battery as its power source It is also adaptable to installation in automobiles with 12-volt batteries, the RCA team said.

While the experimental radio resembles present car radios in its external appearance. the scientists said it requires no vibrator, power transformer, or rectifier — elements needed in vacuum-tube car radios to increase and control the power level

They also emphasized that the transistorized radio maintains a high level of performance over the widest range of temperatures likely to be encountered in automobile service In laboratory tests, it has performed satisfactorily at temperatures as low as —40° F and as high as 176° F they said

—*The Rose Technic*

New Rubber

X-ray diffraction photographs of a new rubber, developed by scientists of Goodrich-Gulf Chemical Co, Cleveland, Ohio, show that it has the same molecular structure as crude, or tree rubber.

The new rubber is now being used in large truck tires giving service comparable to tires made wholly of crude rubber Heavy duty truck tires have, until now, required tree rubber to assure acceptable performance practically the only type tire in which man made rubbers are not entirely satisfactory

Goodrich-Gulf Chemicals will shortly build a pilot plant in Ohio to produce the new rubber, it was announced

Device Tells Day for Any Date

On what day of the week were you born? On what day will your birthdate fall in the year 2137?

A new device invented in Britain and a few twists of the wrist will tell you instantly The desk-sized calendar can give the day of [illegible] for any date from 1800 to 21[illegible] no simple task even for an brain. The presently used

calendar contains so many irregularities and inconsistencies that the problem becomes a maze of complex calculations.

But the new gadget, called a "Calendar Determinant" measures only 10 inches by 7½ inches. By means of slides, it can display the calendar for any Gregorian month in a span of 400 years. Its range could be extended indefinitely.

It also gives the dates of Easter and Whitsuntide, a matter of great importance in England for solving legal and business problems.

Development of the device by Osmond Robin of Croydon was described in the *Journal of the Horological Institute of America*, which called it a "remarkable commentary on the inconsistencies of the Gregorian calendar, which requires so ingenious a device to enable one to determine a past or future date."

Tougher Plastic

A tough, lustrous plastic, chemically related to polystyrene but said to surpass the popular styrene-based material in all uses from aircraft parts to zither cases, has been produced by a new, low-cost process, it was reported to the American Chemical Society.

Disclosing the results of rigorous tests in which, he said, the new plastic outshone styrene-based material in virtually every case, James A. Melchore of the American Cyanamid Co.'s research division asserted that the improved plastic molding compound should open up even broader fields of application. Styrene plastic, which can be made crystal clear or in a variety of sparkling colors, is widely used in such diversified products as electronic equipment, advertising signs, toys, and textile machinery

The new material, a chemical cousin of styrene known as methylstyrene, possesses all of styrene's desirable properties and out-performs it in resisting impact and high-temperature distortion according to Melchore.

Like styrene, methylstyrene becomes an even better product when mixed with another plastic material, acrylonitrile, the chemist observed He said methylstyrene appeared superior to styrene either alone or in combination

Speedy Rail Cutter

A portable, electric, motor-driven rail cutter which will speed up the construction and rehabilitation of military railroads has been developed by the U. S Army Engineers' Research and Development Laboratories. The machine is capable of handling two 39-foot rails, ranging from 70 to 155 pounds per yard, simultaneously, and produces a clean, burn-free surface satisfactory for welding. It can cut a 152-pound-per-yard rail in less than 45 seconds It took the

Largest Plastic Structure

A 4-story high, 55 ft -diameter sphere made of reinforced plastic materials has been completed by Lunn Laminates Inc. of Huntington Station, L I, N Y This is said to be the world's largest rigid plastic structure.

The clearspan three-quarter sphere identified as a "Geodesic structure" by its inventor Dr Buckminster Fuller, president of Geodesics, Inc., Cambridge, Mass , will be used as a shelter for military purposes. (The specific applications have not been released) Dr Fuller pioneered the Dymaxion houses which are suspended from central masts and can be erected by workmen in only one day.

The 55-foot Geodesic plastic sphere

was molded of 363 parts by Lunn Laminates These parts are designed in circles and polygons for structural strength and gasketed with neoprene The durability of the fiber glass laminated material makes it impervious to extreme changes in temperatures The Geodesic plastic dome can withstand wind velocity up to 200 mph

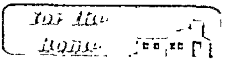
In weight comparison this 6-ton plastic structure is much lighter than a conventional dome A crew of 8 men easily assembled the dome in a total of 288 hours although none of the men doing the work had ever seen such a structure before

Unique Contraption Releases Leaflets

A device which mechanically blended a bicycle wheel, alarm clocks and razor blades to successfully drop millions of anti-Communistic leaflets from giant balloons behind the Iron Curtain was invented and produced by scientists in the Minneapolis engineering laboratories of General Mills Mechanical Division

Several hundred of these unusual balloon units crossed the Iron Curtain last summer Paul Yost and John Macgowan the two General Mills engineers who developed the device capable of dropping 450 pounds of pamphlets, sometimes totalling 100 000, on a given target, performed the initial launchings in Germany

The leaflet-carrying device attached to each 34-foot plastic balloon has the appearance of a bicycle wheel Each 9-pound packet of leaflets is suspended from a cord attached to the rim at regularly spaced points An alarm clock initiates 2 slowly moving motor-powered razor blades around the rim of the wheel, cutting off cords holding packets of the leaflets at fixed intervals.



Router and Jig-Saw

A portable electric tool for home craftsmen and hobbyists, the Routo-Jig, combining the functions of a jig-saw, router, jointer and shaper table, has been introduced by Porter-Cable Machine Co of Syracuse, N Y A circular base makes it a router while a rectangular base converts the machine quickly for jig-saw work Attached in an inverted position to a shaper table, the tool becomes a shaper and jointer

Sander and Massager

A combination polisher is also a sander, and of all things massager, all in one tool When your muscles ache from working around the house, you can give yourself a relaxing, do-it-yourself massage High-styled in jet black and yellow, the tool never requires oiling, has no gears or brushes to wear out or replace It is made by Dremel Manufacturing Co Racine Wis

How To Care for Marble

If you have a marble-topped table in your home you'll want to give it proper care and Mrs Dorothy O Twardock University of Illinois home furnishings specialist makes these recommendations to help you

Just sponge marble with lukewarm water for ordinary cleaning she says Then wash it twice a year with a mild detergent to remove ingrained dirt

To avoid stains, wipe up spills immediately If the marble does become stained, a poultice will usually produce good results For the poultice just soak paper napkins or cleansing tissues in the solution you've found best fo

stain you want to remove You'll find that placing a glass or plastic bag over the poultice keeps it from drying out.

The time required for removing stains will vary from 1 hour to 2 days, depending on the age of the stain. When the stain has disappeared, shine the marble with a soft cloth. If you like a polished surface, you can apply cream wax to colored marble Don't apply it to white marble, though, Mrs. Twardock says; wax will eventually yellow.

TV Listener

A listening device that attaches to the audio system of television sets and permits children to hear their favorite programs without disturbing others is being marketed by Telex, Inc., St. Paul, Minn. The device consists of a control unit with volume controls and on-off switch and is connected to the TV set's output circuit by a 15-foot cord, 2 jacks and a Telex Earset receiver which plugs into the jacks.

Automatic Light Switch

An automatic switch is a light-sensitive mechanism that turns lights on, when it grows dark outside, and off when it becomes light again Unlike clock-type switches, this gadget is able to turn the lights on at a different time each night.

The "Nitelighter" turns on lights in living room, hallway, stairway, garage, enclosed porch, etc, at dusk—off at daylight. Gives light when it is needed—regardless of time, season or weather Just plug the light you wish controlled into special plug, face Nightlighter "eye" toward window, connect to any 110-volt 60-cycle outlet. Marketed by Empire-Lion Sales Co, Brooklyn, N.Y.

Snow Shovel on Wheels

A snow shovel on wheels is designed to take the strain out of removing snow from walks and driveways The 30-inch blade on this manual snow plow can be adjusted easily to push snow to the right or left, or forward. The plow is of sturdy steel construction and rolls easily on rubber tires. It is built by Leisure Industries, Forest Hills, N. Y.

Sewing Machine Attachment

A device, called Sew Strate, can be quickly attached to any home or power sewing machine.

According to the manufacturer, Sew Strate Co., Trenton, N. J., it not only enables the novice to learn to sew straight seams but also makes it possible for experienced machine users to sew faster and better.

Sew Strate is a plastic panel, grooved to serve as a straight-sewing guide. It's attached to any sewing machine, with 2 screws provided

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Articles in italics are usually less than page length BC is Back Cover; IBC, Inside Back Cover; IFC, Inside Front Cover